FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

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Founder and Editor : STANLEY SPOONER

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"FLIGHT" PHOTOGRAPHS.

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list :—

1927

Feb. 1 **"Super-charging for Aero Engines." Mr. A. H. R. Fedden, before R.Ae.S.**
Feb. 10 **Paper (to be announced later). Mr. H. P. Folland, before Inst.Ae.E.**
Feb. 17 **"The Design and Operation of Commercial Aircraft." Major R. H. Mayo, before R.Ae.S.**
Feb. 22 **"The Manufacture and Testing of Mechanical Units for Aircraft." Lieut.-Colonel L. F. R. Fell, before Inst.Ae.E.**
Mar. 3 **"The Spinning of Aeroplanes." Mr. L. W. Bryant, before R.Ae.S.**
Mar. 8 **"Portable Hangars." Major H. N. Wyllie, before Inst. Ae.E.**

EDITORIAL COMMENT.



IN a short time the Air Estimates for 1927–28 may be expected to be published, and, very naturally, there is considerable speculation in aviation circles as to what they will reveal. Until the return of Sir Samuel Hoare from his Eastern tour it seems unlikely that any announcement will be made, but doubtless the Secretary of State for Air will lose no time upon his return. We are naturally without knowledge of the policy of the Government as regards this year's Budget, but it must not be forgotten that the general strike and the coal strike have to be paid for, and that will mean that once more "economy" will necessarily be the watchword. On the other hand, there is an opinion prevalent among aviation folk that a very considerable unspent balance remains from last year's Air Estimates, and this balance must be returned to the Treasury. Now, we have no means of knowing, at the moment, from which votes this balance is mainly left over, but it seems reasonable to suppose that a goodly proportion of it has been "saved" from the vote for "Technical and warlike stores"—in other words, from the vote for aircraft and engines. If that is actually the case, it points to the fact that once more there has been uncertainty and lack of system in the method of placing orders.

Security in the Air

This is a subject to which we have previously referred. Under the present arrangement aircraft firms can never be assured of how their orders will come along. The consequence is that what usually happens is that for the first few months of the financial year most of the firms have little or no work to do. Staffs have to be kept down to a minimum, workmen have to be discharged in the hope that when orders do materialise the men will still be available. Then (perhaps) an order is placed, and if it be one of any magnitude the firm is faced with the problem of getting their men together again. Follows a period of feverish activity, involving more often than not a great deal of overtime working. By the time the order is completed there is usually another period of

waiting, when the same process is repeated. It is perfectly obvious that under such conditions machines cost a great deal more than they need do if more continuity in the placing of orders were the order of the day. That, of course, is merely another way of saying that there is needless waste of money. Either, for the same money, the tax-payer should get more machines, or he should pay less for the same number of machines. That is one direction in which the Air Ministry can economise without sacrificing security.

In his speech at the last Royal Aero Club house dinner Mr. C. R. Fairey referred to the reduction of squadrons from 52 to one-half of that number. We are aware that many thought he was exaggerating the case. Yet an examination of the latest Air Force list discloses the fact that, although we have a total of 45 squadrons, the number stationed at home is only 28, not counting reserve and auxiliary squadrons. Thus Mr. Fairey cannot be accused of having overstated his case. And probably few will venture to suggest seriously that 28 squadrons for home defence, this figure including a large number of army co-operation squadrons, is an adequate number. We have often likened the money spent on air defence to an insurance premium, and we have previously pointed out that paying a premium for an insurance for £1,000, when the value of that which is insured is £2,000, may look like economy at first sight, until something happens. Then one is faced with a loss only half covered by the insurance, and the false nature of the economy becomes painfully apparent.

It seems incredible that the Government, faced as it is with the urgent necessity for economy, can contemplate further reductions in air expenditure. That economies must be effected all agree, but we do suggest that in the matter of air defence the economy must come by a better system of placing orders, not by reducing the vote, and by ruthless cutting of other and less essential services.

The Air League

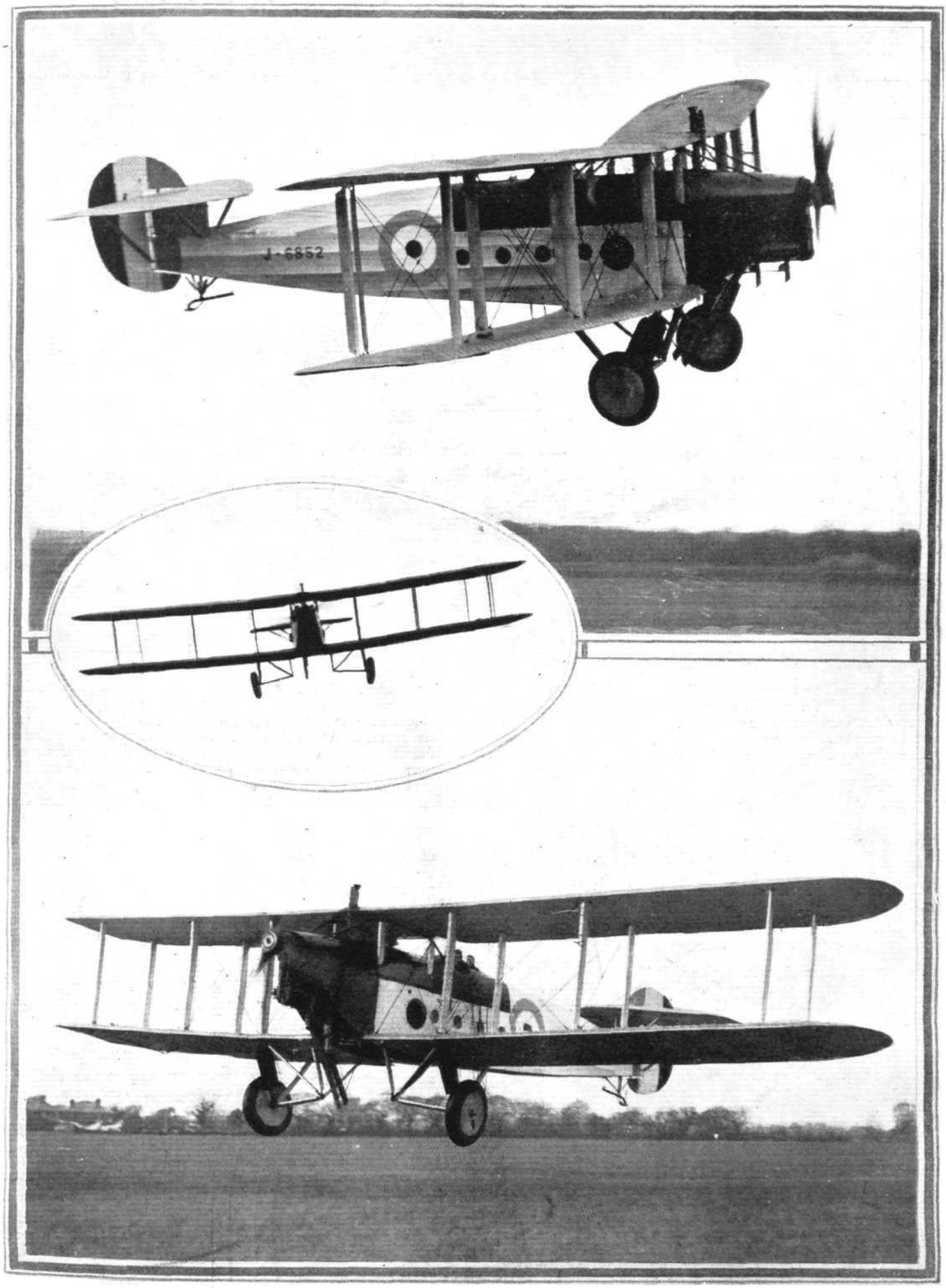
Recently a good deal of publicity has been given in the daily press to an offer rumoured to have been made to the Air League of the British Empire. If reports are to be credited, this offer takes the form of an annual grant of £5,000 for two years by someone whose identity has not at the moment been disclosed. Now it is no secret that this offer is accompanied by certain reservations, and it appears that some of those at present responsible for the conduct of the Air League fear that the offer is the outcome of an attempt to remove from their hands the management of the League. We wish it to be perfectly clear that we have no quarrel with anyone connected with the Air League, and the only thing with which we are concerned is the furtherance of the "air sense," as Sir Samuel Hoare has termed it. Propaganda for the air is obviously the legitimate function of the Air League, and so long as the League performs that function it has our whole-hearted support. But can it be said truthfully that the League has hitherto done what it might reasonably be expected to do in that direction? Frankly, we think not. If the League is to be of any real service to the cause of aviation it must revise its methods. It must keep up with the times. It must be vastly more alive than it has shown any signs of being so far. Whether it does this under the present regime or under a new one does not greatly interest us. The time has come, however, when those responsible for the conduct of the League must realise, to use an Americanism, that they must either "get on or get out."

Private Flying

The subject of private flying is some what to the fore at the moment. It was discussed rather thoroughly at the last Royal Aero Club dinner. Firms are announcing machines intended for the private owner at prices which are at any rate encouraging, even if they are not as low as might be desired. Now there can be no doubt that in the past, official restrictions have done a great deal to hamper the progress of private flying. But as Major Buchanan pointed out at the dinner, what is primarily wanted is to separate private flying from commercial flying. All the restrictions of airworthiness certificates, pilots' certificates, log books, &c., are doubtless necessary in the case of commercial aircraft flying "for hire or reward." But they are certainly not essential in the case of private flying. That is exactly what FLIGHT has been preaching for years, and we are glad to have even the private opinion of an Air Ministry official that he agrees. Perhaps it is not too much to hope that the official view will follow along the same lines. We are aware that already the restrictions on private flying are less exacting than they were originally. But that is not sufficient. They must be abandoned altogether. As we have often pointed out, the usual safeguards in the way of damage to third parties, being a public danger, and so forth, are adequate to deal also with the air. Why, then, impose a lot of restrictions in the case of private aircraft, which after all, are far less of a danger to other people than are the motor cars on our roads? Let us then separate entirely private flying from commercial flying. We do not believe the Air Ministry will mind, as it will be thereby relieved of a good deal of responsibility. We are certain that responsible aircraft firms will welcome such a step. And finally, the removal of restrictions would immediately tend to make private aeroplanes cheaper.

Schneider Cup this year

Just as we are about to go to press with this week's issue of FLIGHT, it is learned that at the meeting of the *Fédération Aéronautique Internationale*, held in Paris on January 25, it was decided to hold the next race for the Schneider Cup this year, and to make it once more an annual event. It will be recollected that originally the race for the Schneider Trophy was held annually, but that a short time ago it was decided to change it to a biennial race. We are now, apparently, about to go back to the yearly basis. As regards this year's race, we are rather glad that this is so. The three British types are nearing completion, and as it seems likely that the race will not be held until September, we should, if work is pushed on vigorously, have sufficient time for thorough testing of machines and training of pilots. No time must, however, be lost, otherwise we shall have another example of sending untried machines and inexperienced pilots (as regards the fast seaplanes, of course) to the race. In the future, however, we are not so certain that it is altogether desirable to hold the race annually. It takes time to develop racing machines of the Schneider Cup type, and one year is none too long in which to produce a new machine.



["FLIGHT" *Photographs*

The Avro "Aldershot" fitted with the new Beardmore "Typhoon" engine in various attitudes of flight, piloted by Mr. Bert Hinkler. The inverted engine results in an excellent view from the pilot's cockpit.

THE BEARDMORE "TYPHOON" MARK I ENGINE

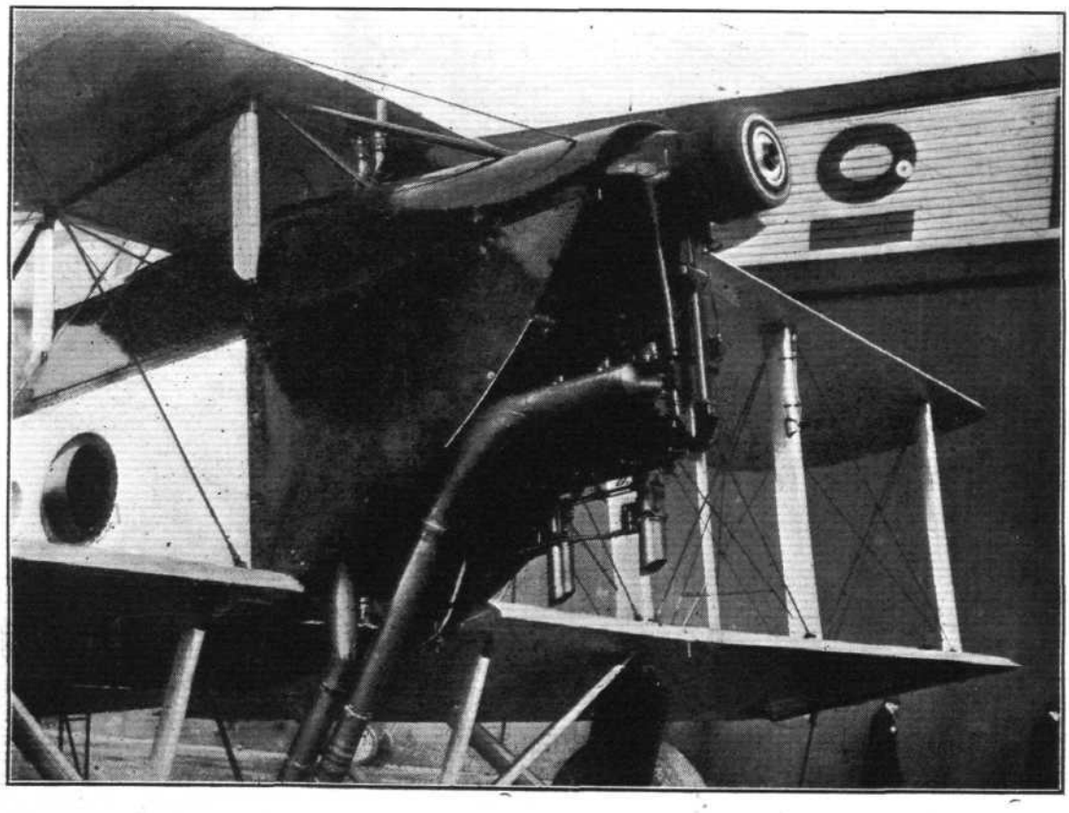
Flying in the Avro "Aldershot"

IF one were to attempt to sum up the outstanding features of the new Beardmore "Typhoon" engine in as few words as possible, it could be done as follows:—"Six Cylinders, 800 h.p., 1,350 r.p.m." Yet that would not entirely cover the case, and one should add that the engine is of the inverted type, facilitating the aircraft designer's work of giving his machine a "clean nose" and the pilot a good view. Under these four heads, however, is really included all that is essential in the somewhat radical departure from standard practice which the "Typhoon" represents. It may be recollected that in our issue of November 4, 1926, a brief illustrated description of the Beardmore "Cyclone" engine was given. That engine is to all intents and purposes similar to the "Typhoon," except that it is "right way up." The fact of "inverting" the "Typhoon," however, has several important results, not the least important of which is the manner in which the engine may be accommodated in the nose of an aeroplane. It is a somewhat curious fact that although the "inverted" type of engine was in use in aircraft long before the war 1914-18 (for instance, there was an inverted German aero engine, we forget at the moment whether it was a Mercedes or a Benz), the type has received relatively little attention in modern times. The Americans have done almost everything that it is possible to do with the "Liberty" engine, even to turning it into an air-cooled, and they have also got it to run upside-down in a flying boat. In this country there have been rumours of an engine of the feline tribe being inverted, but Air Ministry shyness has prevented any reference to it. Generally speaking, however, very little has been done with the inverted type of engine for aircraft, and yet when one



The Avro "Aldershot" with 800 h.p. Beardmore "Typhoon" engine. Three-quarter front view.

["FLIGHT" *Photograph*



The Beardmore "Typhoon" is a six-cylinder "inverted" engine. Our photograph shows it mounted in the Avro "Aldershot". The radiator is placed aft of and below the engine.

["FLIGHT" *Photograph*

comes to think of it, the type might almost appear to be the logical one for installation in an aircraft.

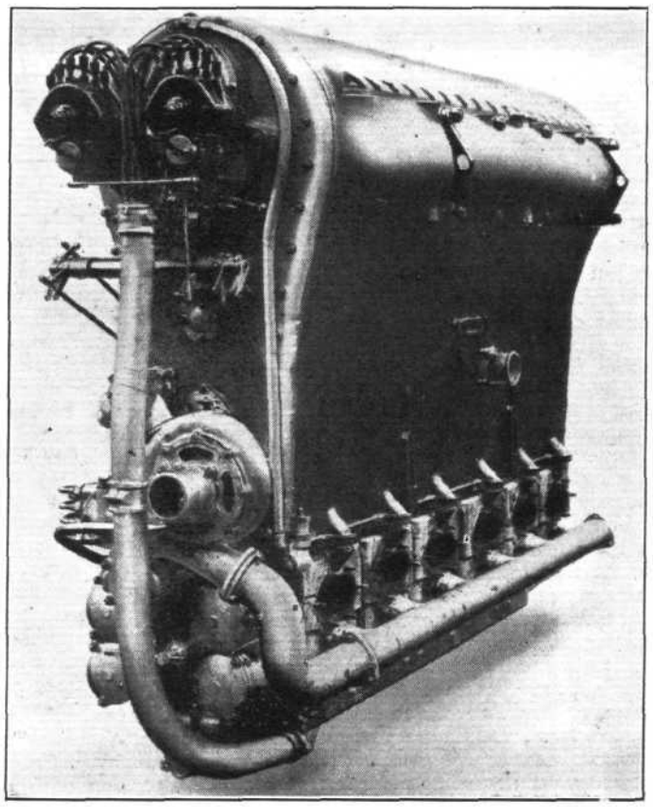
In the case of the Beardmore "Typhoon," which measures perhaps some 4 ft. in height, the inverted position is certainly the obvious one. To get the line of thrust somewhere near in its proper position, it would be necessary to have the tall cylinders projecting upwards a very considerable distance, offering resistance and obstructing the view of the pilot. By reversing it the thrust line is kept in its natural position, the cylinders hang down in front of what has in any case to be a deep fuselage, and the nose, owing to the small width of the crankcase, can be narrowed down so as to obstruct the view forward as little as possible. Other advantages that may be expected from the inverted engine are: The greater facility with which gravity feed can be arranged, as the carburettors are automatically placed lower for the same position of crankshaft, and in all probability less noise, as both the exhaust ports and the overhead valve mechanism are situated much farther away from the cockpits, &c. It is not claimed that with these few items all the advantages of the inverted type of engine have been stated, but they do serve to show that there is much to be said in favour of so arranging an engine.

In other respects also the Beardmore "Typhoon" breaks new ground, or perhaps it would be more correct to say that it represents a successful attempt to carry the development of the familiar six-cylinder in-line engine much further than had at one time been thought possible. To get at least 800 h.p. out of six cylinders is no mean achievement, but to obtain that power at a speed as low as somewhere in the neighbourhood of 1,350 r.p.m., is something so out of the common as to merit very close investigation. Unfortunately, Air Ministry restrictions prevent this from being done at the moment, but without contravening any rules it is possible to generalise. It will be realised that by keeping the number of cylinders down to six, the number of moving parts is very small indeed, which should greatly facilitate maintenance. Also the in-line arrangement results in an engine of low frontal area and consequently low drag.

Of very great importance is the fact that the engine develops its power at low speeds of revolution. In a relatively slow aircraft, such as a bomber, or a commercial machine designed for flying normally at cruising speed, this means that good propeller efficiency can be obtained without the complication of gearing. While on this subject, we would refer to an article which appears in this week's issue of our technical supplement, THE AIRCRAFT ENGINEER. The author of this article, Mr. C. C. Walker, calls attention to the appalling waste of power with which we have hitherto cheerfully put up. This waste occurs in taking off and climbing, and may often result in less than 50 per cent. of the maximum power being utilised during a take-off. As regards commercial machines, the result is that we are limited not so much by what load per horse power a machine will carry, as by the load with which it will get off in a reasonable run. Mr. Walker points to the two-speed gear-box or the variable pitch propeller as the solution of the problem. It would appear that engines of the Beardmore "Cyclone" and "Typhoon" type, with their low speed of revolution, offer another solution.

The high-speed aero engine obtains good fuel economy and light specific weight by its speed. That there are other ways of attaining at any rate the former of these desiderata seems evident from the fact that it is claimed that a fuel and oil consumption of 0·46 lb./h.p./h is easily obtained with the "Typhoon." Concerinng the weight per horse-power of the "Typhoon" we are not permitted to speak at the moment, but the figure is, at any rate, by no means excessive, and for flights of long duration the specific weight soon becomes of less importance than the fuel consumption.

Although the speed of revolution is low in the "Typhoon" the piston speed is probably very high, owing to the long stroke, but when we saw the engine flying in one of the Avro "Aldershot" bombers on January 24 at the Hamble aerodrome, there was a marked absence of vibration. In fact Mr. Bert Hinkler informed us, after his flights, that the engine ran remarkably smoothly. With the machine standing on the ground and the engine just "ticking over," a slight trace of vibration was noticeable, but certainly no more than is found in other engines under similar conditions.



The Beardmore "Typhoon" Mark I, exhaust side. This engine, although of the six-cylinder in-line type, develops 800 h.p., and a later model is even more powerful. The speed is only about 1,350 r.p.m.

The installation of the "Typhoon" in the "Aldershot" is still of a somewhat experimental nature, but it is not difficult to see that a very clean nose can be provided. At present the engine is almost totally exposed, but as it has been found that it tends to keep rather too cold, doubtless a certain amount of cowling and fairing will be tried, when a very efficient combination should result.

The advantages of the engine are obvious, and the difficulties of producing any new engine, let alone one of unorthodox type, are so great that one can heartily congratulate Wm. Beardmore & Co., on their initial success. The engine has been in the air, and the rest is a matter for steady development. A logical outcome is, perhaps, the heavy-oil semi-Diesel engine, but that is "another story." Incidentally it seems very fit and proper that A. V. Roe & Co., the pioneers of British aviation, should provide the machine in which the new engine first took the air. Another milestone has been erected on the road of aviation progress.

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Institution of Aeronautical Engineers' Medals

THE Council of the Institution of Aeronautical Engineers have unanimously decided to award the Sir Charles Wakefield Medal to Mr. L. Bramson, A.C.G.I., M.I.Ae.E., for his invention the Savage-Bramson Anti-stall Gear. They also decided to award the Institution's silver medal to Flight-Lieut. G. H. Reid, D.F.C., for his inventions of the Reid Control Indicator and the Reid Re-action and Testing Apparatus.

Japanese Honour for R.A.F. Mechanic

THE King has given authority to Mr. William Thomas Ellis, late Air Mechanic, First Class, R.A.F., to wear the insignia of the Sixth Class of the Order of the Sacred Treasure, conferred on him for valuable services by the late Emperor of Japan.

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The Royal Air Force Memorial Fund

THE usual Meeting of the Grants Sub-Committee of the fund was held at Iddesleigh House, on January 20. Lieut.-Commander H. E. Perrin was in the chair, and the other members of the Committee present were:—Mrs. L. M. K. Pratt-Barlow, O.B.E. and Squadron-Leader Douglas Iron, O.B.E. The Committee considered in all 17 cases, and made grants to the amount of £88 14*s*. The next meeting was fixed for February 3, at 2.30 p.m.

R.A.F. *v.* Cambridge University (Rugby)

AT the R.A.F. *v.* Cambridge Rugby match played at Grange Road, Cambridge, on January 19, the R.A.F. team was beaten by two goals and five tries (25 points) to one goal and two tries (11 points).

AIRISMS FROM THE FOUR WINDS

Second Madagascar Flight Concluded

THE French pilot, Commandant Dagnaux, who left Le Bourget for Madagascar on November 28, arrived at Majunga on January 21. He was flying a Breguet XIX A.2. (Renault) biplane, and flew a slightly different route than that followed by Lieut. Bernard, for his machine being a land 'plane, he flew direct across the Sahara to Niamey on the Niger, after which his route was more or less the same as Bernard's. He has taken much longer to complete his journey—nearly two months—as compared with Bernard's flight, having experienced several delays en route. Dagnaux's progress may briefly be logged thus :—Depart Le Bourget November 28, and after bad weather delays at Lyons, Istres and Alicante arrived at Oran on December 3 ; Colomb-Bechar on December 4 ; Adrar on December 5 ; Gao on December 6 ; Niamey on December 7 ; Maradi on December 10 ; Tesrao on December 11 ; Zinder on December 12 ; Ft. Lamy on December 14 ; Ft. Archambault on December 15 ; Bangi on December 19 ; Kinshasa on December 22 (held up here for six days by torrential rain) ; Luebo on December 28 ; N'Dola on January 14 ; Broken Hill on January 16 ; Tete on January 18 ; Quilimane on January 19 ; Mozambique on January 20 ; and Majunga on January 21. Throughout the entire trip machine and engine did not give the slightest trouble, and it was due entirely to bad weather—Dagnaux stated that he did not see the sun once during his journey across Equatorial Africa—that the flight took longer than was anticipated.

Night Flying in Germany

THE German Lufthansa, which is the combination controlling German air routes like our Imperial Airways, has been experimenting with night flying over a period of six months on their Berlin-Dantzig-Konisberg line. From May 1 last year to November 15 it was operated, always carrying passengers, mails, newspapers and freight ; and the results show 100 per cent. regularity and 100 per cent. security. This was the only line on which experiments were made, a distance of 405 miles, but it has fully justified Lufthansa inaugurating night services from Berlin to the west and south when the spring begins. When they are established it is thought that the air voyage from London to Peking will be reduced by several days.

New Canadian Air Line

THE Canadian Transcontinental Airways Company, a Corporation which has just received its Letters Patent, is commencing in June next a regular air route between Chicoutimi, Montreal and Toronto. Delivery dates are now being arranged of the aircraft which are being constructed in Europe. The service will make stops at Riviere du Loup, Quebec, Three Rivers, Montreal and Ottawa, between the termini Chicoutimi and Toronto.

Geneva-Madrid Air Line

ANOTHER new air service on the Continent will be inaugurated this summer between Geneva and Madrid. There will be three stages. Geneva to Marseilles, approximately 240 miles, Marseilles-Barcelona, a direct sea flight by seaplane of approximately 250 miles, and then west to Madrid, by aeroplane again, approximately 360 miles. Starting each morning the service will take 10 to 11 hours and convey mails and passengers. The total distance is about 850 miles.

A New Aerial Sport

ACCORDING to an *Evening News* correspondent, America has originated a fascinating aerial sport called " balloon jumping," which has become very popular, and is shortly to be introduced in this country. The lifting force is a balloon filled with gas, about 15 ft. diameter, secured firmly to the jumper's shoulders, who carries loose ballast in his pockets by which he is balanced up until the positive weight is 4 lbs., so that the balloon has a lift equal to all but 4 lbs. of his weight. Thus when the jump is made the force of gravity to be overcome is reduced to 4 lbs. instead of being the normal weight of 150 lbs., and the result is a tremendous increase in the length and height of the jump with the same energy. An effort that would otherwise mean a 2 ft. height with a 6 ft. distance would, under these conditions, create a 40 ft. ascent and a distance of 100 yards. With the help of strong winds jumpers have crossed stretches of country by a series of gigantic leaps. There is something amusingly grotesque in this sport, and a comparison to the ingenious aerial inventions of H. G. Wells is inevitable. These leaping figures would be natural inhabitants of his future worlds, and it would surprise us if they are not really the imitators of some of his imaginative super-civilised characters. The giants and ogres of our fairy stories who stepped from hill to hill strike the imagination instinctively as we picture men leaping the countryside. We feel anxious to try this sport. It is perhaps the nearest idea to flying without wings. What a sensation to fly with no obvious support like the cockpit, as though suspended by a strong invisible thread ! It is suggested by the well-known aeronautical consulting engineer, Lieut.-Colonel W. A. Bristow, that a rigid framework should be used as a method of transmitting the thrust from the intrepid jumper to the balloon for more effective jumping.

Stirling Expedition Employs Aeroplane

ON their expedition into the interior of Dutch New Guinea (Papua) Professor Stirling's expedition used an aeroplane to cross the mountain barriers, reaching a ceiling of 9,000 ft. and making maps of the entire region of the Rofflaer River, which had hitherto been unknown. An intention to fly from the coast to Lake Habbema, which has an estimated altitude of 12,000 ft., was abandoned, the information desired being obtained elsewhere.

Hankow Pictures by Air

THE first pictures of the fighting in Hankow were brought from the East to the western coast of America, rushed across the States by air and on reaching this country, at Plymouth, they were again conveyed by air to London by Mr. G. P. Olley, the pilot, in 1 hr. 50 min.

Air Raids in China

IN the Eastern warfare the Southerners raided Kiukiang on the Yangtse, 130 miles south-east of Hankow by aeroplanes and drove the people from the town after a severe debacle.

Continental Air Service Held Up

OWING to the fall of snow on January 21, and the prevalence of fog the London-Paris service was temporarily suspended.

Air Minister's Tour

SIR SAMUEL HOARE, who is making an aerial tour of inspection of the R.A.F. stations in N.W. India, visited Kohat and Kurram valley, returning after to Peshawar, on January 19. On the following day he visited Risalpur.

Sir Sefton Brancker in Delhi

SIR SEFTON BRANCKER flew from Basra to Karachi on January 21, and next day proceeded, in a R.A.F. machine to Delhi.

Australian-Built D.H.'s

DE HAVILLAND machines are already largely employed on the various commercial air lines in Australia, and some " 50's " have even been built under licence out there, while the " Moth " has become very popular amongst the flying clubs and private owners. It is interesting to note, therefore, that a "D.H. Expeditionary Force" under the command of Major Hereward de Havilland is on its way to Australia for the purpose of establishing a branch of this famous aircraft constructing firm in this Dominion. " Moths " and " 50's " will probably be the first machines to be produced, and it may be of interest to mention that Australian timber, having demonstrated its suitability for aircraft construction, will be employed.

U.S. Army 'Planes Visit Canada

TWELVE aeroplanes from the 1st Persuit Group U.S. Army Air Service, left Selfridge Field, Mich., on January 24 with the object of visiting Ottawa and Montreal. After a flight of 2 hrs. 55 min., the squadron arrived at Ottawa, where they landed on the ice on the river near Parliament Buildings. The machines were fitted with skis.

A New Fuel for Aero Engines

RECENT tests of a new air fuel called " Makhonine " were carried out in Paris on a twin-engined aeroplane belonging to the Air Union. The fuel is supposed to contain the advantages of heavy-oil fuel and petrol ; it is not inflammable, it can be used in standard engines, is cheap,and very economical.

More " Moth " Owners

THREE new " Moths " are shortly being delivered to three titled air pilots, viz : Lady Bailey, who obtained her certificate as a pilot at the London Light Aeroplane Club, Lord Ossulston and the Hon. Geoffrey Cunliffe.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

January 27, 1927

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OUR CONTRIBUTORS

Mr. C. C. Walker, who, as most of our readers are probably aware, is chief engineer and designer of the de Havilland Aircraft Co., Ltd., is a very welcome contributor to the present number of THE AIRCRAFT ENGINEER. Having been associated with Captain Geoffrey de Havilland for a considerable number of years, Mr. Walker has had a very extended and many-sided experience in everything pertaining to aircraft design and construction, and consequently an article from his pen is entitled to be read not only with interest but also with a great deal of respect. Mr. Walker has chosen for his subject that of the efficiency of aircraft during climbing, and he shows that in very many cases only some 50 per cent. of the maximum horse-power of the engine is being made use of in taking a load off the ground. He further shows that this excessive loss is not inevitable, and that in fact a vast improvement can be effected by either fitting a two-speed gear or a variable pitch airscrew. In the example taken the rate of climb is raised from 516 ft./min. for the direct-drive engine to 735 ft./min. for the geared engine and to 920 ft./min. for the variable pitch airscrew.

Mr. J. D. North summarises, in the present issue, the position of the aircraft designer. In futur articles he will deal with the subjects which, in his opinion, are most likely to hold out a promise of better performance, *i.e.*, the engine and propeller. In the present issue Mr. North makes the useful suggestion that the problem of "interference" be systematically attacked by the Aeronautical Research organisation. This would necessitate close co-operation of the designing staffs of aircraft firms, but as Mr. North points out, if there are ten contributors to the common stock of knowledge, each stands to receive nine times as much as he gives, so that presumably, as Mr. North puts it, "no commercial damage could result to any firm working on genuine lines."

Captain F. L. M. Boothby, R.N., suggests the use of fuel tanks made of pliable but inelastic material, a layer of inert gas being interposed between inner and outer tank. In addition to the advantages claimed in the article, the author points out to us that evaporation of fuel in a hot climate would be prevented. Using metal tanks with air vents in airships results in a strong smell of petrol in the keel. The collapsible tanks would require no air vent.

CLIMBING EFFICIENCY OF AIRCRAFT.

By C. C. WALKER, A.M.Inst.C.E., F.R.Ae.S.

It is often said that no great aerodynamic improvements are in sight and that the efficiency of aircraft as transport vehicles is only capable of ordinary steady development. While this is, no doubt, somewhere near the truth so far as aerodynamics are concerned, it is, perhaps, worth while to see what margin there may be for improvement without looking very far ahead or relying on the doubtful possibility of new discoveries.

The rate of climb at ground level is of obvious and vital importance in bombers and commercial machines, but less so for types which possess a great margin of power and have to develop their qualities at heights. Since the weight that can be transported is limited to that which can be safely taken off the ground, the efficiency in the climbing condition becomes important. It is quite common to find that only 50 per cent. of the brake horse-power at maximum revolutions is being turned into useful work in this condition, and if an improvement in the efficiency of, say, 5 per cent. could be secured, the improvement in climb would be much more than this owing to the fact that the power used in merely sustaining the aeroplane is constant and any increase in available power is a relatively large percentage of that used in actually climbing.

If the brake horse-power developed at maximum speed flying level is taken as the basis, it may be divided up as follows when climbing :—

(1) Minimum horse-power required to sustain level flight.

(2) Horse-power returned as actual climb.

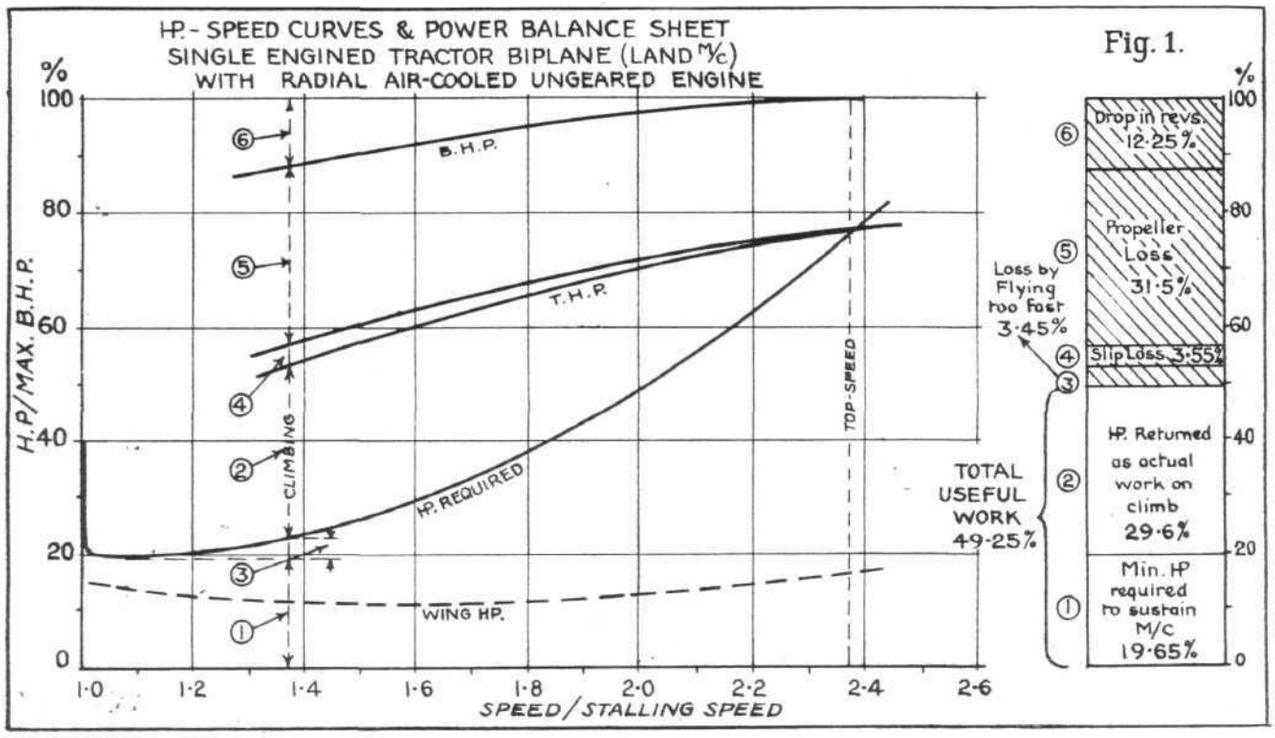
(3) Owing to the compromise between the aircraft and propeller curve, the best climbing speed is higher than that for minimum horse-power. The difference is lost work.

(4) The extra drag in the slipstream, or whatever may be included in this term. This is really an *excess* loss over that incurred at maximum speed.

(5) The horse-power lost by the propeller in turning brake horse-power into thrust horse-power.

(6) The horse-power lost (or rather, not used) by the engine losing revolutions when climbing.

It is best to regard Nos. 1 and 2 as useful work for the present purpose, as machines of different weight per horse-power can then be compared easily. As regards No. 4 it might be supposed that the same fraction of the thrust horse-power would be lost by the slipstream impinging on obstacles at all values of V/nD. This does not appear to be the case, and is probably due to the fact that the slipstream contracts more at climb than at speed.



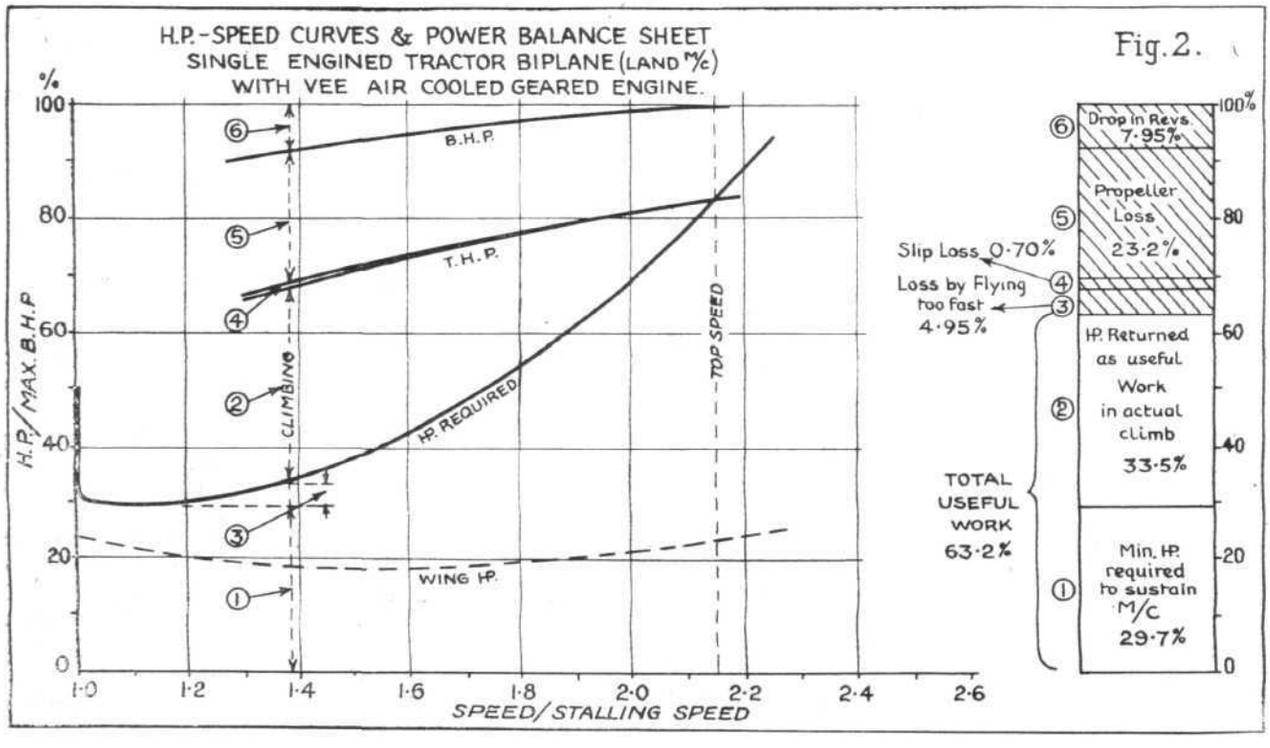
Loss No. 5 is, of course, affected by the speed range of the machine, since a propeller working at a much lower forward speed (climbing) than that for which it is designed, is correspondingly inefficient.

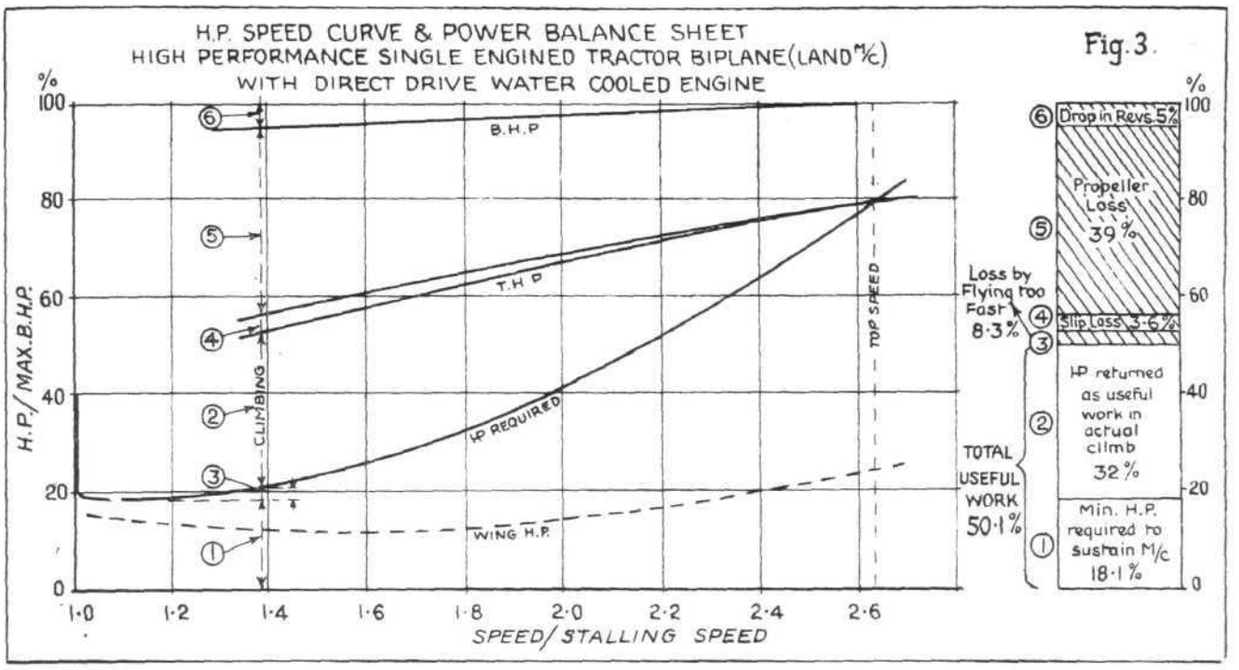
The figures given illustrate the sort of value which may be encountered in practice, and are taken from actual examples of modern aircraft.

Figure 1.—This shows that under 50 per cent. of the maximum brake horse-power is made use of on the climb, and that the drop in revolutions accounts for 12·25 per cent. which is an unusually large amount compared with water-cooled engines. This figure is, of course, susceptible of considerable variation, as it depends on induction, heating, etc. In the case given, the engine is capable of functioning satisfactorily at heights and in low temperatures, and there is no doubt that when the cooling is relatively less, as in climbing near the ground, a smaller loss of revolutions could be secured by deliberately going out for it. It is probable that low-ceiling machines, such as heavy Bombers or Passenger Carriers, require a special intake and induction system on air-cooled engines.

Figure 2.—This illustrates a case in which everything is favourable to efficiency on the climb—the speed range is low owing to the weight per horse-power being high and, therefore, the propeller is still working under tolerable conditions on the climb.

The 2 : 1 gear reduction (the engine is a 90 R.A.F.) not only permits a high propeller efficiency, but also sufficient diameter to keep the slipstream clear of obstruction even on the climb. The smaller drop in revolutions compared with Figure 1 is,



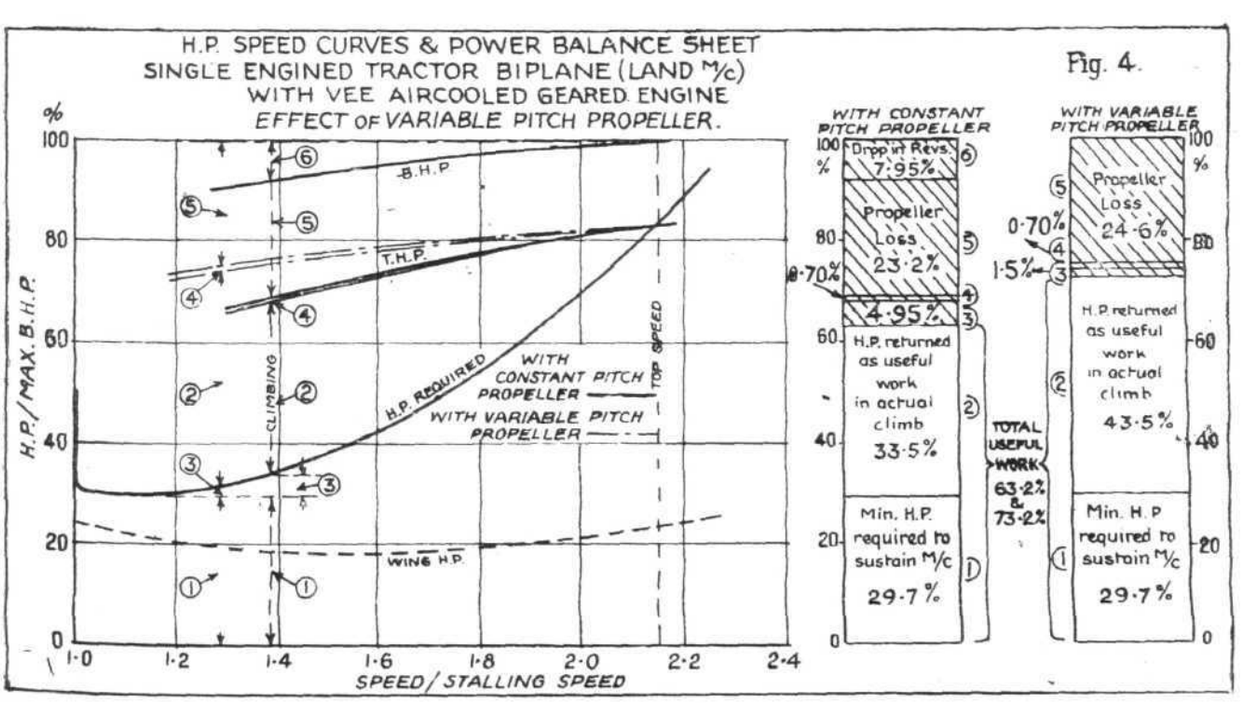


of course, partly due to the smaller speed range, and any possible engine temperature effect can only be disentangled from propeller phenomena if a large number of tests are available. An examination of a great number of tests of de Havilland aeroplanes, extending over 11 years, shows that on the whole there is a much greater drop in power on the climb in air-cooled than in water-cooled engines.

Figure 3.—This figure relates to a water-cooled, ungeared, outfit of fairly high speed range, and shows the inevitably bad propeller and slip conditions, which are, however, compensated to some extent by the small drop in revolutions. As the speed range of aircraft is increased, the need for the variable pitch propeller becomes more insistent, but if performance at great heights only is required, where the speed range is much contracted, this is not so much the case. Nevertheless it may be found that when operating from temporary war aerodromes exceptionally good "take-off" and "climb" qualities will always be useful.

A word is necessary, perhaps, as to how the "horse-power" required, shown in these curves, is arrived at. There are, of course, many different ways of doing this, but the following seems to be more free from uncertainties than others. The level speed and rate of climb are carefully ascertained for ground level, and it is then assumed that the propeller efficiency at speed and drag of the wing surface alone is known (there is much full scale, theoretical and other evidence on this point). The intercept between the wing and total horse-power is then considered to vary as the cube of the speed. The horse-power available curve is put in in the usual way. It will then be found that the measured climb is less than would be indicated by the intercept between these curves and the difference is debited to the propeller as "slip loss" or rather additional losses from obstructions over and above those incurred at speed. This somewhat crude method of displaying what is measured in routine tests has certain advantages when comparing many different results.

There has always been some discussion as to whether engine power varies more nearly as the pressure or the density.



So far as water-cooled engines are concerned, anyone dealing with a large number of tests of aircraft using the same engine, must have noticed that the density theory gives somewhat inconsistent results in varying temperatures, and this seems to be generally admitted. It also seems inherently likely that in a water-jacketed induction system and cylinder the amount of charge will be fairly independent of the atmospheric temperature, in other words that the (indicated) horse-power will vary as the pressure. As regards air-cooled engines, while the writer has had no opportunity as yet of sifting available data, it seems equally likely that atmospheric temperature will affect the amount of charge by affecting the temperature of the cylinder walls, in other words, that the pressure law will not be applicable. If this is the case, there will be a difficulty in knowing what brake horse-power is actually being obtained under varying conditions of flight. Thus if we suppose that on some particular day in level flight at maximum speed, the engine temperature is the same as during the bench test on which the power curve was obtained, then if the machine is climbed at about half the forward speed the engine must be warmer than on the level test and the power output less than on the bench at the same revolutions.

Some of the losses of power considered above may seem to be rather small, but the climbing qualities of aircraft are sensitive to small variations of power and the commercial qualities are sensitive to the climbing qualities, so there is no doubt as to the commercial, and in many cases military, importance of these losses.

The advent of either a variable pitch airscrew or a two-speed gear will get rid of loss numbers 3 and 6 in the figures above, and produce the result shown in Fig. 4, where it is applied to and superposed upon the Fig. 2 results. In this case, the use of a water-cooled engine is presupposed, or alternatively, that there is no temperature-effect loss of revolutions if it is air-cooled.

Now the conditions shown in Figs. 1 and 3 are not exceptionally bad, and as the tendency to boost power by increasing revolutions proceeds, the climbing efficiency there shown tends to become more common and even worse. It may be repeated that the results shown with the antique power plant of Fig. 2 are obtained on an existing aeroplane and are due only to decent propeller conditions, and the further improvement of Fig. 4 is obtained without looking very far into the future.

There is a tendency in some quarters to view propeller performance only in the speed condition, and this may be responsible for the prevailing inadequate slipstream areas.

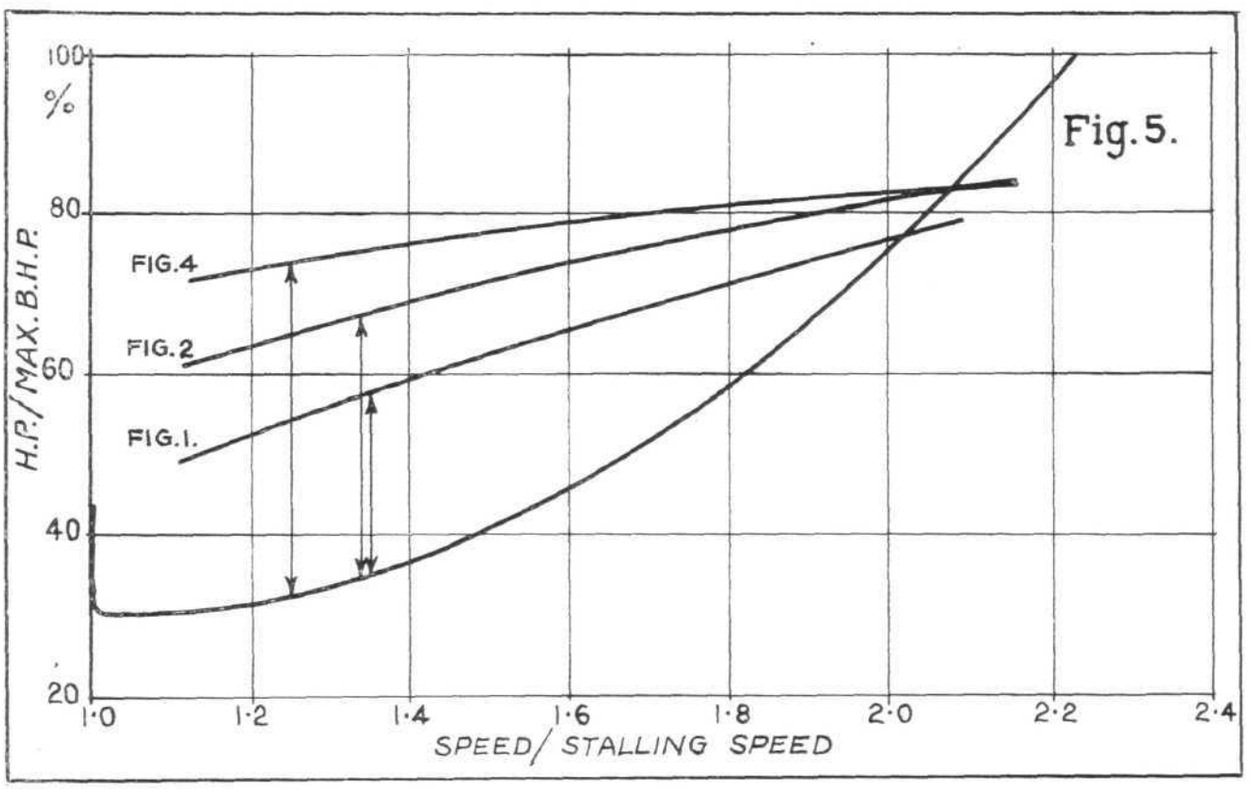
We will now look in a quantitative way at three of the cases taken above and will illustrate them by applying the three efficiencies of Figs. 1, 2 and 4 to an imaginary commercial aeroplane of characteristics suited to the Fig. 1 power plant.

Fig. 5 shows the power available in each case on an aeroplane having a power and surface loading of about 14·75 and 10 respectively and carrying about 4½ lb. per horse-power of paying load with the power plant of Fig. 1, *i.e.*, an air-cooled, ungeared, radial engine of fairly high revolutions.

The curve marked 2 relates to the engine with a 2 : 1 reduction gear, and that marked 4 to the same with a variable pitch propeller.

The rates of climb in the three cases are 516 : 735 : and 920 ft./min.

There are many different ways of looking at the advantage gained between the two extreme cases ; it is possible to retain the advantage of a large reserve horse-power, to instal an engine of 75 per cent. of the power and carry more load (at a rather lower speed), or to increase the total weight and retain the original climb and "get off."



Space will not permit of going into these cases in detail, nor of discussing the advisability or otherwise of adding to mechanical complications, but when it is seen that the imaginary aeroplane considered above (which may be taken as a limiting "get off" case) could now get off with the same facility but with nearly 20 lb./h.p. total weight, a figure which would mean that in some cases the paying load per horse-power could be doubled, the magnitude of the losses frequently incurred now can be easily realised.

It is evident that from the purely aerodynamic point of view it would pay to have the propeller revolutions so low that the efficiency at speed would begin to suffer somewhat but, of course, there are many practical considerations in these things, and the object of this note was to indicate that we frequently only make use of 50 per cent. of the maximum brake horse-power of the engine in taking a load off the ground, that this loss is not inevitable, and the effort to

get engines of low weight per horse-power by boosting revolutions is very little use to bombers and commercial machines.

AIRCRAFT PERFORMANCE.

By J. D. NORTH, F.R.Ae.S.

(*Continued from p.* 101.)

We have now touched on most of the factors which go to influence the performance of an aeroplane and which are, more or less, within the control of the aeroplane designer. Before passing to questions of the power plant, I propose to summarise the position of the designer as I see it today.

Prior to the application of the vortex theory there was always vague talk of greatly improved wing sections; hopes and promises in this direction sometimes reminded one of that delightful gas for airships, so beloved of fiction writers, which has "twice the lifting power of hydrogen." Most people with a smattering of engineering or scientific knowledge are aware that the buoyancy of an airship is due to the difference of weight of hydrogen and that of the air displaced by the gas bags and that hydrogen is so light that even were its weight reduced to nothing (*e.g.*, if the gas bags were "filled with vacuum") only a small change of buoyancy would result. The prospect of improved wing sections or wing arrangement is as remote as improved buoyancy from a new gas. We can now design our wing sections on logical lines to suit our requirements without reasonable expectation of new discoveries to improve them. The slotted wing, which is the only real aerodynamical invention of the decade (apart, perhaps, from the Autogyro, which is another story), has been shown in a previous article to offer little advantage in improving performance except in extending the speed range by lowering landing speeds. The vortex theory has discredited the once fancied aerodynamic advantages of the mon-plane, showing that the biplane is always the more efficient lifting arrangement for a given span, and making it possible to demonstrate that the drag of struts and wires in a well-designed biplane is comparable with the increase in profile drag of the wing thickened to accommodate internal structure. In my opinion the Continental practice relating to monoplane construction is specially associated with rigid wing covering and I believe English practice to be fundamentally sound.

Apropos of the comparison of monoplanes and biplanes, it is important to remember that comparison on the $\frac{\text{span}^2}{w}$ basis can only be made between the two types by reducing the biplane to the equivalent monoplane. The figures in last month's AIRCRAFT ENGINEER for the Paris show would require to be so adjusted to enable the biplanes to be compared with the monoplanes. The correction figures were given in an early article (*see* THE AIRCRAFT ENGINEER, April 29, 1926, pp. 40, 41, 42—ED.), and depend on relative span of top and bottom wings and also on gap/span ratio. The figures for the biplanes reduced to a monoplane basis will all be *better*. Biplane practice is so common in England and the monoplane is such a rarity that one is accustomed to think in biplane terms, and variations of practice in gap/span ratio give rise to errors of a secondary order only in comparing one biplane with another.

Apart from the increase of span necessary in order to keep down induced drag to the biplane figure, owing to the chord having also to be enlarged, in order that the landing speed should be no greater, it is necessary to have a longer body as stability considerations make the length of the aeroplane as between main plane and tail plane approximately proportionate to the chord. There is compensation in a smaller tail plane and smaller rudder and, in certain cases, a long tail may be necessary to get balance (*i.e.*, to get the centre of gravity in the right relation to the mean chord), but on the whole the monoplane seems to adapt itself to exceptional cases where special and peculiar advantages outweigh its inherent disadvantages.

Improvement in body drag is largely out of the control of the aeroplane designer. He will make as good a form as the engine designer and the demands of his service or commercial customer will allow. The balance in the latter case is struck from considerations of policy; improvement in performance may be got by the sacrifice of military advantages—a fact not to be forgotten in comparing the performance of one aeroplane with another. The most fruitful field for aerodynamic development is undoubtedly the interference problem. Systematic work in this direction is very difficult, and perhaps in consequence it has hardly been tried. There is, however, an immediate method by which a vast amount of light might be thrown on the obscurities of the subject. Many experimental aeroplanes are built every year by different firms in the aircraft industry. All these aeroplanes are the subject of a careful performance estimate based on available knowledge, frequently reinforced by special wind channel tests. These same aeroplanes are subsequently tested at an official testing station, in addition to tests by their makers. These tests either confirm the designer's estimate or they show a superior or inferior performance. Since the divergencies from estimates are presumed to be due to unknowns, the latter will be the more important. All these divergencies require an explanation, and a section of the Aeronautical Research organisation might be usefully employed in explaining them. In the course of their investigations much will come to light and no doubt avenues of approach will be suggested for a fundamental attack on the problem. It would, of course, be necessary for the investigators to have the fullest co-operation of the designing staffs concerned, and I imagine that no commercial damage could result to any firm working on genuine lines. There is, of course, always a great talk about secrecy, but unfortunately for human nature secrecy sometimes means concealing the fact that there is nothing to hide. The scientific and engineering side of the aircraft world, for example, should not fear to discard "talking points" and stick to actualities. If there are ten contributors to the common stock of knowledge, each contributor stands to receive nine times as much as he gives on the average. Needless to say, what the research organisation would concern itself with would be questions of physical facts, not opinions. Evidence must be carefully weighed, probable accuracy of statistics tested, and once the validity of these are established the solution of every problem will bring immediate strength to aeroplane design, and a reasonable probability that failure to achieve performance for a particular reason will not be repeated, or an unexpectedly advantageous arrangement will have its essentially useful elements analysed for future use. In the next first-class war, unless military history is a misleading guide, early experience will show that the material equipment of the Air Force is not what is required. The slow growth of the military aeroplane during a war is an exceptional circumstance, next time war in the air starts full blast. Very rapidly it may be necessary to change the types of aeroplane used: the more problems of performance which are solved the more certainty there will be in producing the new types required.

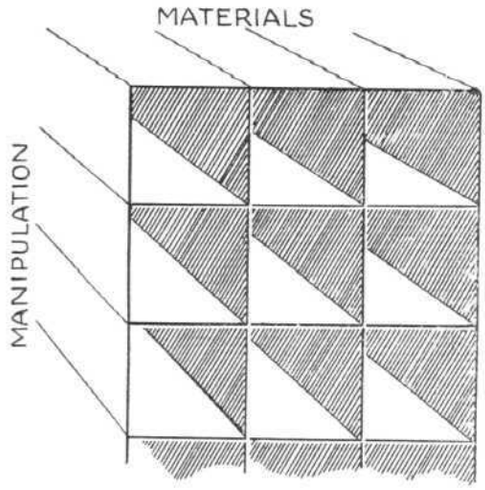
There are some obvious performance failures which require no special investigation, principally those due to the aeroplane being overweight. This is a matter, however, which the designer can well handle on his own, in so far as he is responsible. He ought to know what structure weight is economic and if he fails to get his economic weight there is something wrong with his design. In the weight of wings a designer ought to be most accurately right, since the problem is the most straightforward he has to face; and it is well that it is so, for the choice of $\frac{\text{span}^2}{w}$ must be based on a knowledge of its influence on weight and serious error here will mean error in choice of span. Weight of empennage and undercarriage should also be accurately determinable, but difficulties arise in the case of the body. Primarily, the body is merely a beam connecting the empennage to the main planes, but it has to fill many other functions, and in many aeroplanes over three-quarters of the body is determined by other functions which the body has to fulfill. It is easy to design a good beam to connect the empennage to the main planes, but the arrangement indicated is not practically possible, and uneconomical arrangement of members has to be resorted to from installation considerations. Multiplicity of joints, uneconomical proportions and awkward positioning of members are part

of the price paid for installation of engine and equipment, provision of access from one part of the machine to another, freedom for gun fire, view, &c. This, of course, is necessary, as an aeroplane which cannot perform its military functions, is of little use. But there is an important point to remember. Once an aeroplane exists, the loss of performance or high cost of manufacture occasioned by military installation requirements cannot be recovered, change of policy means complete redesign to return once more to best economic considerations and to get best performance consistent with military requirements.

So also do considerations of policy affect optimum size. The object of the bombing aeroplane is to drop bombs. In order to function, it requires certain signalling and navigation apparatus, certain defensive armament and certain crew, plus its load of bombs. The former represent a fixed minimum and may represent a greater weight than the bombs load. In such case a small increase in size may mean a large increase in effectiveness (*i.e.*, bombs load). As a set-off there is an increase of true structure weight with increase of size. For example, suppose the fixed load of a certain aeroplane to be 25 per cent. of its gross weight. By fixed load, I mean military load and the weight of that part of the aeroplane which is unaffected by change of size. Suppose the true structure to be 30 per cent., and the power plant (including fuel, &c.) 55 per cent. The aeroplane, let us say, weighs 10,000 lb. The fixed load is 2,500, of which the military load might be 2,000 and the bombs load 500 lb. of that. Increase the size of the aeroplane to 12,000. Suppose true structure to increase to 31 per cent., power load remains unaltered. The remainder available for "fixed" load is now 2,880 and the bombs load will be increased to 880 lb., an increase very large compared with that of the aeroplane. The actual figures used are not real, but illustrate the principle. If, as may be the case, bomb load is small compared with fixed load, change in policy which would modify this ratio would have considerable effect on the optimum size of aeroplane. It is true that owing to engine powers available being discontinuous that the "best" size or best performance cannot always be chosen, but this has no effect on the argument since the border line cases are passed from one step to another with more serious results if of less probable occurrence.

We may usefully ask ourselves in what direction weight saving may be expected in the structure. In previous articles I have already suggested maximum simplification of military requirements, careful investigations into forces arising in flight. It seems unlikely that we can afford to consider acceleration factor of less than 2·5 for aeroplanes meant for straight flying. With this factor we shall require a load factor of 1·5 at least or a stress factor of 2 if alternating loads are to be dealt with or materials of low proof/maximum stress are used. There is however, the possibility of new materials or new material technique to be considered. Strip steel for the manufacture of aeroplane spars, etc., has already reached a point of development where improvement in mechanical properties is unlikely to be reflected in much weight saving unless the specific value of Young's modulus could be raised—an extreme improbability. A substantial raising of the specific proof stress for light alloys might have a very marked effect on structural economy, but the large amount of work on aluminium alloys in the last decade has not held out much promise of this. Magnesium is an interesting material and a solution of the corrosion problem would encourage a vigorous attack on the development of magnesium alloys. These developments are perhaps not for the moment. Just now technique is perhaps of more importance. Solid drawn tubing, and streamline wires both lag behind steel strip members and offer profitable opportunities for improvement as structural members, and this is a case not of materials and their manipulation.

It will be as well to explain here the importance of technique to the engineer. In his note to my article on the Paris Show the editor raises the query, *à propos* of a Duralumin stamping illustrated and commented upon, "Is it really necessary?" I suggest that this point is negligible to the engineer. Dr. Aitchison in his interesting articles on Duralumin has pointed out that Duralumin, like other light alloys, has to be forged in a state of less plasticity than steel owing to limitation of safe working temperature. If I look at the example I am surprised that it can be made, more surprised that it can be made cheaply. The acceptance of these two facts modifies my knowledge of the technique of Duralumin drop stamping, that is to say of what I can reasonably ask the drop stamper to make as a commercial article. The actual use to which M. Brèguet puts this part is to me of quite secondary importance, except in so far as I can judge from that use the accuracy of stamping necessary and a reasonable commercial value for the part, knowing the complete aeroplane to have certain value. I think a picture of one section of the technique of the engineer may be given in this way. Imagine a rectangular block of pigeon holes thus:



The vertical rows are labelled with different materials, *e.g.*, various kinds of steel, light alloys, yellow metals and so on. The horizontal rows are labelled with methods of manipulation, *e.g.*, plastic working (such as rolling and drawing, forging, etc.), machining, joining processes and so on. In each of these mental pigeon holes is a specification, partly definite, partly nebulous of the properties and limitations, mechanical and economic, associated with the conjunction of a material and a method of manipulation. This specification is continuously undergoing modification sub-consciously as the result of experience or information and represents the stock-in-trade drawn upon for detail design, etc. Anything which may modify these specifications has consequently an importance which quite transcends its intrinsic utility.

For the purpose of considering the influence of structural and material technique on performance we require a set of pigeon holes as fully filled up as possible and steady improvement is always going on, not only in completing the set exemplified, but the vast number comprising engineering technique as a whole, and each section only exists at any time in its most complete state in many minds. The development of technique is a slow laborious task which makes appeal only to the professional mind but it is of vast importance in its slow attack on obstructions to development and in consolidation of advances made.

In aeronautical engineering as in bridge work there may be noticed a difference in applied technique as scale varies. This is due to the entry of the financial economic factor (or in times of war the man power factor which comes to the same thing). In certain classes of engineering the cost rate is nearly independent of scale (up to the point where handling problems become serious) and in this class raw material is the important factor, cost may be considered as so much per ton. Such an application to an aeroplane, particularly a metal aeroplane, is inadmissible. Geometrically similar wings on a different scale show a decreasing cost per pound with increase of scale. This has the effect of raising the true economic size, since more elaboration can be afforded on the larger aeroplane. Here again modification of technique will affect economic size. Numerous as all these factors are, they are not likely to have more than a secondary influence on design and performance. It is to the engine and propeller that we must turn for the most marked results.

(*To be continued.*)

THE PROBLEM OF THE SAFETY FUEL TANK.

By F. L. M. BOOTHBY, Captain R.N. (Ret.).

Aeroplane accidents are regrettably frequent, and much too often we read that a machine bursts into flames after a crash and destroys the occupants, who may be otherwise uninjured.

An ordinary metal tank is in common use. When partially full we have a layer of petrol vapour lying on top of the liquid fuel, and partially mixed with air, which enters through the necessary vent. Should any spark occur on a crash there is the mixture ready to ignite. A match may be dropped into liquid petrol without ill effect, but a match dropped into the mixture indicated will have evil results. The ideal fuel tank should not permit of this explosive mixture being formed.

A metal fuel tank bursts very easily on striking the ground ; it deforms, and deformation opens the seams or cracks the metal. The perfect petrol tank should be capable of any deformation without affecting its strength. In the ordinary petrol tank air or exhaust gas are admitted into contact with the petrol. Both contain water. The water condenses and the well-known trouble results. The fuel tank we require should not allow of any moisture getting into the tank.

The ordinary fuel tank is connected to the engine by an inelastic pipe ; should the position of the tank relative to the engine increase, even to a small extent, the pipe will be broken and fuel escape. Should an electric light lead be run alongside the petrol pipe the disaster will then be complete, as in R.38.

Let us consider how we can overcome these difficulties, and start from crude principles.

When Kut was being re-provisioned from the air it was the practice to pack such substances as sugar, rice, etc., in a sack. This sack would be enclosed in a larger one. When dropped the inner sack sometimes burst, but the contents were retained by the outer.

Consider a flexible but inelastic bag in the form of a sphere and quite full of liquid. On being dropped the whole of the energy developed will be absorbed in bursting the walls of the bag.

Suppose the same bag to be half full of liquid and half full of air. It will no longer remain in the shape of a sphere and may be constrained by elastic suspension, etc., to take any desired form. On being dropped in this condition the energy generated must compress the air in the tank and shape the tank into such a form that the air pressure is sufficient to burst it. Much work is absorbed in compressing the air and in stretching the elastic suspension, and there is often insufficient energy left to burst the container.

If the container is surrounded by another and larger bag, a double process has to be gone through. The inner container must be burst, and then the remaining energy must be sufficient to compress the air in the outer and burst that—which in practice it generally does not accomplish.

What we can do is to take a tank made of balloon fabric—three-ply is generally sufficient, but any number of plies to give the required strength can be used. This is flexibly suspended inside a larger tank, which in turn is flexibly suspended in the aeroplane's fuselage.

A single lead of flexible petrol tubing is led into the inner tank, passing through a gland on both the outer and inner tank, and so arranged that on a heavy pull being given the piping can slip through the gland. The piping is extended from the top to the bottom of the tank, so that there is a foot or two to draw on should the engine start to move away from the neighbourhood of the tank.

Between the inner and outer tank we take a lead from the exhaust of the engine. The exhaust pressure acting through the walls of the inner tank forces the petrol out through the pipe. Further, it fireproofs the tank, as it drives all air away from the neighbourhood of the fuel and surrounds it with a layer of inert gas. Any incendiary bullet can be fired through the tank without setting it alight.

So far, so good. Now come the difficulties.

Rubber-proofed balloon fabric will not hold petrol, so the fabric must be "doped." There is no difficulty in finding a dope that will resist petrol. Unfortunately aeroplanes now use "cocktail fuels" with a large percentage of benzol. No known dope will stand that. Gold-beater's skin will do so, and it is possible to get a glue that will do the same. The gold-beater's skin and glue do not take kindly to a rubber fabric, so we have to stick them to cotton. This makes a perfectly good petrol and benzol-proof lining. Another difficulty then arises. This lining is petrol-proof but not waterproof. We can take precautions that no water gets into the tank with the fuel, but water from the exhaust gases or from the air might come in contact with the outside of the lining. Fortunately a cellulose dope will render this waterproof.

Our tank then takes this final form : an outer cover of balloon fabric, then a layer of inert gas under pressure from the exhaust, then an inner tank of balloon fabric with a lining of petrol- and benzol-proof fabric.

A single pipe, both for filling and supply, passes into the inner tank and reaches to the bottom, allowing the tank to move relative to the engine without breaking the pipe, as already described.

Such a tank is reasonably crash- and fire-proof, but it must not be cut by sharp metal edges, such as are found on some machines. Generally the cross-bracing wires are sufficient to prevent this, should the tank tend to be thrown towards the engine.

Tanks of this kind can be fitted inside the wings, or under them ; in the latter case they would be made of streamline form and kept in shape by pressure from the exhaust or from the slip stream of the propeller, as in non-rigid airships.

The weight of such a tank is about the same as a metal one of the same capacity.

MORANE-SAULNIER PERFORMANCE FIGURES.

In the table of data relating to the machines exhibited at the Paris Aero Show, which was published in the December 30, 1926, issue of THE AIRCRAFT ENGINEER, no performance figures were given for the Morane-Saulnier monoplanes. As these were school machines this is not, perhaps, a serious matter, but as the figures have now become available it is thought that it may be of interest to give them here so that those wishing to do so may add them in their appropriate place in the table referred to.

Three types were shown, the 129, the 132, and the 35. Following are the missing figures relating to these three machines. The type 129 has a top speed of 200 km./h. (124 m.p.h.), a climb to 4,000 m. in 30·9 mins., and a ceiling of 6,300 m. (20,650 ft.). Its "high-speed figure" is 15·8 and its "altitude figure" 7·7. The type 132 has a top speed of 172 km./h. (107 m.p.h.), climbs to 4,000 m. (13,100 ft.) in 41·5 mins., and its ceiling is 5,300 m. (17,380 ft.). The "high-speed figure" is 15·5 and the "altitude figure" 7·9. In the case of the type 35 the top speed is 131 km./h. (81·4 m.p.h.), the climb to 4,000 m. occupies 53·17 mins., while the ceiling is 4,500 m. (14,760 ft.). The high-speed and altitude figures are 9·2 and 6·7 respectively.

THE "EVERLING QUANTITIES."

In connection with the article entitled "Comparative Quantities in Aircraft Statistics" published in the November 25, 1926, issue of the AIRCRAFT ENGINEER, which was a translation of an article by Prof. E. Everling that appeared originally in the German journal *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, we have received a letter from Mr. J. Vanier, Technical Translator, U.S. Air Corps, McCook Field, Dayton, Ohio, U.S.A., in which the writer points out that, although the German word "zahl" literally does mean "figure," the expression is used in the article in the same sense as the German word "Beiwert," *i.e.*, coefficient or factor. Thus, *Schnellflugzahl* would be translated high-speed factor ; *Weitflugzahl*, distance or range factor ; *Hochflugzahl*, height or altitude factor ; *Bauzahl*, load factor ; *Flugzahl*, criterion for climb and ceiling.

As it is rather important that the right translations should be found for these quantities if they are to pass into the English language, we have very great pleasure in giving here Mr. Vanier's suggested translations, and would ask the opinion of our readers on the subject.

TECHNICAL LITERATURE.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS.

AN EXTENSION OF THE VORTEX THEORY OF AIRSCREWS WITH APPLICATIONS TO AIRSCREWS OF SMALL PITCH, INCLUDING EXPERIMENTAL RESULTS.

By C. N. H. LOCK, M.A., H. BATEMAN, B.Sc., and H. C. H. TOWNEND.

R. & M. No. 1014. (Ae. 217.) (40 pages and 10 figs.) June, 1926. Price 1*s.* 6*d.* net.

The "vortex theory of airscrews"* breaks down over a range of working conditions between zero advance and a certain speed of negative advance. It is suggested that in this range the axial inflow relation of the vortex theory should be replaced by an empirical relation to be obtained by analysing the performance of actual airscrews. To cover this gap in the theory a two-bladed airscrew was tested having a pitch low enough to ensure that the angles of incidence of the blade section should not exceed stalling incidence.

The method of analysis and recalculation of performance is explained in general terms. The complete cycle of possible working conditions of an airscrew considered as an actuator disc is discussed on the assumption that the axial velocity through the disc is independent of radius and with reference to the probable type of flow round the screw in each working condition. The performance of a single blade element of an airscrew of small pitch is then discussed in detail, and it is found possible to describe in a general manner the cycle through which the element passes as the forward speed is varied continuously from a large positive to a large negative value while the rotational speed is kept constant.

Following the description of performance tests on airscrews and aerofoil sections on which the calculations are based, the observed thrust curves of the two-bladed airscrew of aerofoils are analysed for four different values of the blade angle ($+4°$, $0°$, $-2·6°$, $-4°$), on the assumption that the axial velocity is constant over the airscrew disc. Each airscrew provides a separate determination of the required empirical inflow curve; the results for the four screws are sufficiently consistent to support the initial assumptions and to enable a satisfactory mean curve to be drawn for all the screws. This curve is then used to recalculate the thrust and torque of the four screws and also of the four-bladed airscrew of pitch/diameter ratio 0·3 of the family of airscrews, by a method which is identical with that of the vortex theory over the range in which that theory applies, the performance of the elements of different radii being calculated independently of each other. The agreement is satisfactory for the airscrews of aerofoils, and fair for the four-bladed airscrew P/D 0·3 of the family of airscrews whose pitch ratio is greater than the largest effective pitch ratio of the airscrews used in the analysis

The results have all been based on the observed wind-tunnel velocity and apply to a 3-ft. diameter airscrew working in a 7-ft. square closed wind tunnel. The possibility of obtaining a correction to the velocity for tunnel interference is discussed with the help of a number of observations of velocity at different points in the tunnel with the airscrew running; a tentative correction is adopted, but in the region where the correction becomes large it is unreliable.

The method of the present paper may be used with confidence to calculate the approximate performance of any airscrew whose pitch does not exceed the limits of the airscrews used in the analysis. For screws of higher pitch it is still the only method at present available over the range where the vortex theory breaks down.

R. & M. 786.—An Aerodynamic Theory of the Airscrew.—Glauert.
R. & M. 869.—Notes on the Vortex Theory of Airscrews.—Glauert.

EXPERIMENTS ON THE AIR FORCES ON ROTATING CYLINDERS.

By A. THOM, B.Sc. Presented by PROF. J. D. CORMACK.

R. & M. No. 1018. (Ae. 219.) (8 pages, 20 diagrams.) February, 1926. Price 6*d.* net.

The experiments here described were carried out in the 2-ft. wind tunnel in the James Watt Engineering Laboratories at the Glasgow Univerisity, and are a continuation of earlier preliminary experiments. The lift and drag forces were measured for various cylinder diameters and channel speeds, and the effect of rounding the ends and sanding the surface were determined. Some estimate was also made of the torque required to rotate the cylinders in still air. The maximum value of V/D obtained in the experiments was 9·4 ft.²/sec., and the maximum revolutions per minute was 6,000.

SOME FURTHER EXPERIMENTS ON THE BEHAVIOUR OF SINGLE CRYSTALS OF ALUMINIUM UNDER REVERSED TORSIONAL STRESSES.

By H. J. GOUGH, M.B.E., B.Sc., S. J. WRIGHT, B.A., and D. HANSON, D.Sc.

Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1023. (M. 39.) (13 pages and 21 diagrams.) January, 1926. Price 1*s.* 3*d.* net.

A large amount of work has been carried out at the National Physical Laboratory on the behaviour of single crystals of aluminium, and a previous report, R. & M. 995. (The behaviour of single crystals of aluminium under static and repeated stresses) should be consulted.

The paper is an experimental study of the phenomena exhibited by single crystals of aluminium when subjected to alternating torsional stressing. The resulting distortion under this complex type of straining action is observed using slip-band measurements, and is related to the atomic orientation of the crystals by means of X-ray analysis. The observed complicated system of slip-bands is then shown to be in agreement with the simple law that slip is confined, at any point of the surface of the crystal, to one of the octahedral planes and in the direction of the most highly stressed (shear stress) principal lines of atoms. The progressive hardening during a long endurance test has been studied and the phenomena attending the last stages of the test have been isolated from those of the earlier stages. Some quantitative data regarding the hardening by slip have been deduced from ball indentation tests made on cross-sections of the specimens used.

REPORT ON STUDY OF MECHANICAL PROPERTIES OF SILICON-ALUMINIUM ALLOYS. PARTS I AND II.

By J. D. GROGAN, B.A. Presented by DR. W. ROSENHAIN F.R.S.

Work Performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1028. (M. 43.) (16 pages, 8 diagrams.) June, 1926. Price 1*s.* net.

The investigation here described has been carried out at the request of the Light Alloys Panel, Materials and Chemistry Sub-Committee, and has for its object determination of the mechanical properties of cast light alloys of aluminium with silicon (8–15 per cent.). These alloys are manufactured industrially under patent under the trade names of "Alpax," "Silumin," etc.

Tests have been carried out on material prepared at the laboratory, and also on corresponding castings of "Alpax" alloy supplied by Messrs. Light Alloys, Ltd., of London.

The results obtained on "Alpax" are published in R. & M. 1011.

This report is composed of two parts. Part I deals with the sodium method, Part II with the salts method of modification.

A brief account is given of the constitution of these alloys and of the method and effect on microstructure of the "modification" process.

In preparing 1-in. diameter sand and chill cast bars for the tests difficulty has been experienced, due to the presence of calcium in recent batches of commercial silicon.

It was found that the presence of a small amount of calcium of the order of 0·5 per cent. in the silicon was sufficient to produce a modified structure in the cast bars. Irregular results were obtained by the sodium method, which resulted in unsoundness in the castings, and attention was accordingly directed to the "flux" or "salts" method. The maximum results obtained with 1-in. diameter cast bars modified by the sodium method were as follows :—

Silicon per cent.	Condition.	Ultimate stress tons per sq. in.	Elongation per cent. on 2 ins.	Fatigue range tons per sq. in.	Izod value energy absorbed in ft.-lbs.
11·04	... Chill cast	13·7	14·5	± 4·3	—
12·65	... Sand cast	10·9	7·5	± 3·15	—
13·75	... Chill cast	11·8	4·0	± 4·9	2·65

The limiting range of stress in the fatigue tests varies from 30–40 per cent. of the corresponding ultimate stress, a result similar to that obtained from heat-treated 1-in. diameter cast bars of aluminium alloy "Y," where a limiting range of ± 7·0 tons/sq. in. has been obtained with an ultimate stress of 21 tons/sq. in.

The Izod value is superior to that normally obtained from corresponding cast bars of 2L 11 or L 8, but inferior to L 5 or Y alloy. A value as high as 5 ft.-lbs. has been obtained from heat-treated bars of the latter alloy.

EXPERIMENTS WITH A FAMILY OF AIRSCREWS, INCLUDING EFFECT OF TRACTOR AND PUSHER BODIES.

PART IV.—ON THE EFFECT OF PLACING AN AIRSCREW IN VARIOUS POSITIONS WITHIN THE NOSE OF A STREAMLINE BODY.

By H. BATEMAN, B.Sc., A.C.G.I., D.I.C.; H. C. H. TOWNEND, B.Sc.; and T. A. KIRKUP.

R. & M. No. 1030. (Ae. 223.) (27 pages and 11 figs.) February, 1926. Price 1*s.* 3*d.* net.

Experiments were made on a combination of an airscrew and a tractor body with the object of determining the changes in performance produced by placing the screw in different positions within the nose of the body. The shape of the nose itself was also varied, and comparative tests were made with a blunt and a pointed nose.

In addition, alterations in the drag of the body were made by the attachment of various excrescences, with the object of rendering the drag comparable with that of an aeroplane fuselage; the consequent effects of these upon the performance of the combination, and of the airscrew alone, were measured.

With both forms of nose, the maximum efficiency of the combination decreases as more of the screw is enclosed within the nose, falling by 5·5 per cent. with the pointed nose, and by 2·5 per cent. with the blunt nose as the amount of screw shielded is increased from 0·25 D to 0·46 D.

An annular excrescence, of area 0·18 of the maximum area of cross section of the body, ceases to affect the performance of the screw until brought within one airscrew diameter of it. As the annulus is moved closer to the screw (the area being kept constant) the maximum efficiency at first falls, but tends to rise again when the annulus is close up behind the screw, in spite of the fact that in this position the annulus produces the greatest increase in body drag.

If the area of excrescence in any one plane is disposed in some other way than as an annulus (*e.g.*, several segments) the efficiency is likely to be still further reduced, since the excrescence will then project farther into the slipstream; this proved to be so in the one such case tested, viz., that in which the eight large segments were used.

The drag of the body is also given as a function of $\frac{T}{\rho V^2 D^2}$.

It appears that as the body drag increases it is affected by the screw to a diminishing extent.

This research continues the previous work on the same subject described in R. & M. Nos. 829, 830, and 892.*

* R. & M. No. 829.—Experiments with a family of airscrews, including the effect of tractor and pusher bodies. Part I. By Fage, Lock, Howard and Bateman. R. & M. No. 830.—Experiments with a family of airscrews, including the effect of tractor and pusher bodies. Part II. By Fage, Lock, Bateman and Williams. R. & M. No. 892.—Experiments with a family of airscrews. Part III. Lock and Bateman.

THE TORSION OF CIRCULAR AND ELLIPTICAL CYLINDERS OF HOMOGENEOUS AEOLOTROPIC MATERIALS.

By S. J. WRIGHT, B.A.

Work Performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1031. (M.42.) 5 pages. May, 1926. Price 4*d.* net.

In a recent report* it was assumed, for the purpose of comparison with experimental results, that the stress system existing in a circular bar, consisting of a single cubic crystal of arbitrary orientation, when twisted about its axis by terminal couples was the same as that which would exist if the material were isotropic. The present work was undertaken in order to justify this assumption analytically.

Since the assumption of cubic symmetry about arbitrary axes did not simplify the general problem, the stress system due to the torsion of circular and elliptical cylinders of homogeneous, but completely aeolotropic, material has been worked out.

The stress system in each of the above cases is precisely the same as that which would exist if the material were isotropic; the assumption of the previous report is, therefore, justified.

* R. & M. No. 1023.—"Some further experiments on the behaviour of single crystals of aluminium under reversed torsional stresses." By Gough, Wright and Hanson.

THE EFFICIENCY OF AN AIRSCREW.

By H. GLAUERT, M.A., Royal Aircraft Establishment Report No. B.A. 588.

R. & M. No. 1034. (Ae. 227.) (11 pages and 7 figs.) May, 1926. Price 9*d.* net.

For many purposes it is necessary to estimate the probable efficiency of an airscrew designed to absorb a given horsepower, and hitherto it has been necessary to rely on empirical curves or on a rather crude method of calculation.

By means of a few simple approximations to the standard airscrew theory, a general formula has been developed from which the probable efficiency of any airscrew can be calculated in a few minutes.

The formulæ developed in the report have been checked against experimental results, and the efficiency deduced is in close agreement with the observed efficiency. The method of analysis, however, is not sufficiently accurate to determine the thrust and torque of an airscrew separately.

The generalised curves at the end of the report or the equations (IV) can be used to obtain an accurate estimate of the efficiency, which may be anticipated from an airscrew designed to absorb a definite power at given rate of rotation and forward speed. The analysis takes no account of the loss of efficiency which occurs when the tip speed of the airscrews approaches the velocity of sound, and a further empirical correction is necessary in such cases.

Other papers published by the A.R.C. bearing on the analysis of this report are R. & M. Nos. 786 and 829.*

* R. & M. No. 786.—An Aerodynamic theory of the Airscrew. By H. Glauert. R.A.E. R. & M. No. 829.—Experiments with a family of airscrews, including the effect of tractor and pusher bodies. Part I. By Fage, Lock, Howard and Bateman.

ON THE ADVANTAGES OF AN OPEN JET TYPE OF WIND TUNNEL FOR AIRSCREW TESTS.

By H. GLAUERT, M.A., and C. N. H. LOCK, M.A.

R. & M. No. 1033. (Ae. 226.) (10 pages and 3 figs.) May, 1926. Price 9*d.* net.

There are three types of wind tunnel in which large numbers of experiments have been carried out :—the Eiffel type with an open jet, the Göttingen type with the return flow, and the

National Physical Laboratory type having a straight tube. For testing airscrews, the last, namely, the closed N.P.L. type, is not so suitable as the open jet wind tunnel of the Eiffel or Göttingen type on account of the larger correction for tunnel interference.

The evidence for the preference to the open jet type is as follows :—

(*a*) *Theoretical.*—A formula due to Mr. R. McKinnon Wood* is available, which gives a small but definite correction to be applied to a 3-ft. diameter airscrew working in a 7-ft. square closed tunnel. By the same argument the correction for an open jet tunnel is zero. An independent argument† based on considerations of vorticity leads to the same conclusion.

(*b*) *Experimental.*—In the course of experiments on the American family of airscrews Dr. Durand tested a set of four similar airscrews of diameters, 2 ft. to 4 ft., in an open jet tunnel of diameter 5½ ft., and obtained agreement between the performance of the extreme screws. The evidence for the closed type of tunnel is less definite but points to the accuracy of the theoretical formula.

(*c*) *Extreme Working Conditions.*—Under extreme working conditions‡ it is probable that the correction becomes large for a screw in a closed tunnel, and there is some evidence that the open jet tunnel retains its advantage in this case.

* R. & M. 662. Some Notes on the Theory of an Airscrew Working in a Wind Channel. R. McKinnon Wood and R. G. Harris.
† N.A.C.A. Report No. 14. Experimental Research on Air Propellers.
‡ See R. & M. 1014.

REPORT ON THE "BURNING" OF ALUMINIUM.

By J. D. GROGAN, B.A.

Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1035 (M. 44). (12 pages, 5 figs.) February, 1926. Price 1*s.* net.

This research is a continuation of other work described previously in R. & M. 783, "Report of the Effects of Over-heating and Repeated Melting on Aluminium." Other work on the same subject has been reported in Light Alloys Sub-Committee Report 14 published in the special volume of Reports of the Light Alloys Sub-Committee (1921). The object of the present investigation was to find methods of treatment of aluminium which might lead to deterioration in the quality of the metal approximating to the condition generally described as "burnt."

The influence of gases on aluminium has been investigated both by bubbling gas through the molten metal and by melting in a controlled atmosphere. It has been found that tensile tests on material rolled and annealed after treatment with gas did not show that any harm had been done to the metal. Charpy impact tests on chill cast material showed reduced values as the result of overheating in an atmosphere of nitrogen and carbon monoxide, and further reduction by passing gas through the metal while still overheated, the reduction being substantially independent of the gas used. The notched bar impact test figure is partially restored by remelting the gassed material in air and still more in vacuo. Hydrogen passed through molten aluminium at normal casting temperatures lowers the test figure very appreciably ; carbon dioxide is less harmful. Nitrogen appears to be beneficial, though the evidence of this is somewhat contradictory. Repeated melting and rolling of high-grade material does not lessen the impact figure. The solubility of carbon in aluminium does not exceed 0·06 per cent., and carbon does not produce brittleness in that metal.

THE CONSTITUTION AND AGE-HARDENING OF SOME TERNARY AND QUATERNARY ALLOYS OF ALUMINIUM CONTAINING NICKEL.

By KATHLEEN E. BINGHAM, M.Sc.

Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1036 (M. 45). (13 pages, 16 diagrams.) April, 1926. Price 1*s.* net.

This investigation deals with (1) the age-hardening of some of the ternary alloys of copper, nickel and aluminium, the constitution of which has been investigated by the present author jointly with Dr. J. L. Haughton (J. Inst. Met., Vol. XXIX, No. 1, 1923) ; and (2) the constitution and age-hardening of similar alloys with the addition of small percentages of magnesium.

Three series of copper nickel aluminium alloys have been investigated, containing respectively 2 per cent., 4 per cent., and 6 per cent. of copper, while the nickel in each series was varied from 0·2 to 2 per cent. Hardness measurements have been carried out during the ageing of the alloys for three weeks. Only very slight age-hardening has been observed, the maximum increase in hardness, 16 per cent., occurred in the 4 per cent. copper series and appears to be due to the separation of $CuAl_2$. The observations suggest that the slight increase in hardness may not be permanent, as after the alloys have attained their maximum hardness, on further ageing, the value falls back to that obtained in the quenched condition before ageing.

The constitution of the alloys containing 1 per cent. magnesium has been investigated (see page 2), at 500° C. and 200° C. The nickel content has been varied up to 2 per cent. and the copper up to 6 per cent. On comparing the constitution of these alloys with that of the ternary alloys of copper, nickel and aluminium, to which reference has been made, this investigation has shown that the addition of 1 per cent. magnesium has caused a decrease of solubility of $CuAl_2$ and the ternary constituent at 500° C., but no new constituent has appeared. On slowly cooling these alloys to 200° C., it has been shown that an additional constituent, the compound Mg_2Si, has separated as well as $NiAl_3$, which now takes the form of fine needles, while at higher temperatures it occurs only in rounded pieces.

The hardening of the alloys containing 4 per cent. copper, 1½ per cent. magnesium and nickel varying from 0·2 to 2 per cent., has been investigated (see page 10), on ageing at room temperature for different periods up to a year after quenching from 500° C., and also after tempering at different temperatures.

A marked increase in hardness has been found throughout the series on the first day after quenching from 500° C., followed by a more gradual rise up to the 15th day and succeeded by a fall on the 43rd day ; a further marked increase in the hardness has been noted at the end of a year. In most cases, the best of the tempering results have been obtained after eight days at 150° C.

The greatest increase of hardness after ageing at room temperature took place in the alloy containing 2 per cent. nickel, while the hardest alloy of the series is the one containing 0·2 per cent. nickel. It is suggested by this investigation that the marked age-hardening which takes place in this series of alloys is due chiefly to the precipitation of magnesium silicide (Mg_2Si), very little being due to the separation of $CuAl_2$.

MECHANICAL PROPERTIES OF PURE MAGNESIUM AND CERTAIN MAGNESIUM ALLOYS IN THE WROUGHT CONDITION.

By S. L. ARCHBUTT, F.I.C., and J. W. JENKIN, B.Sc., Ph.D.

Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1037 (M. 46). (13 pages and 8 figs.) February, 1926. Price, 9*d.* net.

The use of magnesium and its alloys is of considerable importance where the saving of weight is a first consideration, as this metal is much lighter than aluminium. Cast magnesium alloys have already been used in aeroplane engines and research is needed on the wrought alloys. The present work commences a research to fill this gap in knowledge and the materials chosen for study include pure magnesium, 3 per cent. and 13 per cent. copper alloys, 6 per cent. aluminium alloy and the proprietary alloy, Electron, in the form of 1 in. diameter rod.

The properties of these materials were determined : (1) at atmospheric temperatures both in the condition as rolled or supplied, and after exposure to elevated temperatures, and (2) at elevated temperatures after both short and prolonged exposure. The microstructure has also been studied in so far as it bears upon the work.

Typical values of the mechanical properties at atmospheric temperatures of the hot-rolled rod so far determined are as follows.

	Pure Magnesium.	6 per cent. Aluminium.
Tensile—		
Diameter of testpiece, inches ...	0·564	0·564
Maximum stress, tons/sq. in. ...	15·7	18·3
Yield stress, tons/sq. in.	(slight and indefinite)	
Limit of proportionality, tons/sq.in.	1·60	2·40
Elongation, per cent. on 2 in. ...	12·5	20·0
Reduction of Area Modulus, lbs./sq.in.	$6·25 \times 10^6$	$6·30 \times 10^6$
Fatigue (Wöhler tests)—		
Endurance Limit—		
Range of stress on basis of 20 million reversals, tons/sq. in. ...	±4·5	±6·5
Impact—		
Energy absorbed, ft. lbs. Charpy...	4·3	5·1
Izod ...	3·8	4·6
Hardness—		
Brinell. 500 kg. load, 10 mm. dia. ball—period of application, 30 secs.	39	50

STRESSES IN A STIFF JOINTED POLYGONAL FRAME UNDER A SYSTEM OF LOADS PERPENDICULAR TO THE PLANE OF THE FRAME.

By J. F. BAKER, B.A. Presented by Professor A. J. SUTTON PIPPARD, M.B.E., D.Sc.

R. & M. No. 1039 (Ae. 228). (9 pages and 7 diagrams.) February, 1926. Price 9*d*. net.

In two recent papers,* by Professor Pippard, solutions have been given for the stresses set up in a stiff jointed polygonal frame under the action of load systems lying wholly in the plane of the frame.

Certain cases have arisen in which the load system is not confined to forces acting in this plane and, in the present paper, formulæ are developed for the case in which the loads act in directions perpendicular to the plane of the frame.

As in the earlier papers, the frame is of regular polygonal form, made up of members equal in length, cross-section and elastic properties, and rigidly connected at their extremities so as to form a single stiff ring.

* R. & M. 820 and R. & M. 912.

THE ACCURACY OF THE VORTEX THEORY OF AIRSCREWS IN THE LIGHT OF RECENT EXPERIMENTAL WORK AND ITS APPLICATION TO AIRSCREW DESIGN.

By H. GLAUERT, M.A., and C. N. H. LOCK, M.A.

R. & M. No. 1040 (Ae. 229). (16 pages and 9 figs.) June, 1926. Price 9*d*. net.

The vortex theory of airscrews as developed in previous papers* is essentially a modification of the earlier inflow theory which had been built up as a semi-empirical system on the basis of Froude's momentum theory and Drzewiecki's blade element theory.

The present paper deals with the accuracy of this theory when checked against the available results of wind tunnel experiments on model screws.

A brief general discussion is given of the nature of the theory and of the points in which it differs from the earlier inflow theory. The experimental data may be classified as follows :—

(1) Total thrust and torque of an airscrew.

(2) Pressure distribution over the airscrew blades.

(3) Total pressure head behind an airscrew employed to determine the thrust grading curve.

(4) Airflow round an airscrew including the determination of the torque grading curve from observations of velocity and direction just behind the airscrew.

(5) Certain special experiments.

The accuracy of the experimental results is considered and is found to be satisfactory except in one or two points of minor importance ; A slight uncertainty of the interference of wind tunnel walls, especially near zero advance ; an uncertainty in the determination of thrust grading from measurements of total pressure head near the tip of the airscrew blades.

The comparison between theory and experiment is classified under the various headings given above. The general agreement is very satisfactory, and all the serious discrepancies on total thrust and torque occur (*a*) for small velocity of advance ; (*b*) for airscrews with a small number of blades ; (*c*) for airscrews of high pitch ratio.

The agreement on total thrust is satisfactory except for a slight discrepancy near zero thrust which is greater for a two-bladed airscrew than for a four-blader, and a tendency for the calculated thrust curves to be steeper than the observed.

The agreement on total torque is satisfactory except for screws of experimental pitch ratio greater than 1·2 for which the calculated torque becomes larger than the observed.

In comparison with experiments which determine the variation of force, pressure and velocity along the blades, the agreement is generally good except that there is a tendency for the theory to over-estimate the thrust and torque near the blade tips.

* R. & M. No. 786.—An Aerodynamic Theory of the Airscrew. By H. Glauert. R.A.E. R. & M. No. 869.—Notes on the Vortex Theory of Airscrews. By H. Glauert, R.A.E.

AN INVESTIGATION ON WING FLUTTER.

By R. A. FRAZER, B.A., B.Sc.

R. & M. No. 1042 (A. 4). (22 pages and 5 diagrams.) February, 1926. Price 1*s*. net.

The present paper extends earlier theoretical work on flutter. The main underlying assumptions are, firstly, that a certain proportion of each wing moves under an elastic constraint in roll about some axis inboard of the interplane struts ; and secondly, that twist does not develop.

The dynamical equations are obtained on a more exact basis than has been considered expedient hitherto, and the motion is analysed in some detail, with reference to the illustrative case of a particular biplane.

With the rolling axis selected very close to the interplane struts the motion is stable at all speeds ; but as the axis is brought farther inboard, flutter develops over a range limited by an upper and a lower critical speed.

The motion at general flying speeds is compounded of a "higher frequency" and a "lower frequency" oscillation. The former becomes rapidly and markedly unstable in the range defined by the critical speeds, whereas the latter is increasingly stable. The instability at a flight speed only 9 ft. per second in excess of the critical value is such that after the first 4 or 5 secs. following a small initial disturbance, the motion is no longer amenable to a small oscillation theory.

An evaluation of the separate terms in the moment equation indicates that the twisting deflection which the rolling motion tends to induce at any instant is comparatively small. Unless twisting instability develops concurrently, and damps the motion in roll, the results of the present theory will not be impaired.

If the centre of mass of the aileron be very near to the hinge, flutter of the type considered will almost certainly be avoided.

Three immediately useful lines of further development are suggested. The first is a re-examination of the theory to allow for neglected terms ; the second is an extension to cater for wing twist ; and the third a controlled experimental check of the theoretical work in a wind tunnel.

PHOTOGRAPHS OF THE FLOW ROUND A MODEL SCREW WORKING IN WATER, ESPECIALLY IN THE "VORTEX-RING STATE."

By C. N. H. LOCK, M.A., and H. C. H. TOWNEND, B.Sc.

R. & M. No. 1043 (Ae. 230). (5 pages and 10 diagrams.) May, 1926. Price 9*d*. net.

The modern theory of the action of an airscrew is based on the assumption that any blade element passes through the air in a helical path and reacts on the fluid in the same way as a similar element of an aerofoil moving in a straight path. Over a certain range, including moderate values of the thrust,

considerable progress has been made in determining the general velocity field and mean velocity through the airscrew disc (see especially R. & M. 786*). For extreme values of the thrust where the same methods break down, an attempt has recently been made to obtain an empirical relation to determine the velocity through the airscrew disc by analysing some experiments on model airscrews in a wind tunnel (see R. & M. Nos. 1014† and 1026‡); in addition, the actual velocity field has been photographed under extreme conditions, including the windmill brake state.

The photographs given in this report show a considerable turbulence around the screw, but the actual degree of turbulence can best be judged by visual observations. The photographs suggest that most of the fluid which actually passes through the screw circulates continually in a closed path, but visual observations indicate that this is not the case; on watching individual oil drops it appears that few of them pass through the screw a second time, and very few a third time. Owing to the small scale of the experiments, it is obvious that the constraint of the boundaries of the stream exerts a considerable influence on the velocity distribution.

* R. & M. 786. An aerodynamic theory of the airscrew.—H. Glauert.
† R. & M. 1014. An extension of the Vortex Theory of Airscrews with applications to airscrews of small pitch and including experimental results.
‡ R. & M. 1026. The analysis of experimental results in the windmill brake and vortex ring states of an airscrew.

SOME PHYSICO-CHEMICAL STUDIES ON THE EFFECT OF SUNLIGHT ON COTTON.

By GUY BARR, B.A., D.Sc., and ISABEL H. HADFIELD, M.Sc.

R. & M. No. 1016 (M. 36). (22 pages and 9 figures.) July, 1926.* Price 1*s.* net.)

Fabrics after exposure to sunlight of periods from 3 days to 5 weeks and from 6 hours to 42 hours have been compared by the viscosity of their solutions in cuprammonium hydroxide solution.

The determination of the viscosity of a solution of cotton in cuprammonium hydroxide solvent has proved to be an extremely sensitive method of following the deterioration due to sunlight, particularly in the early stages. An exposure of six hours' duration to bright sunlight was found to produce a significant reduction in viscosity.

Cellulose modified by exposure to sunlight and air for short periods show increased reducing properties and an initial decrease in absorption of methylene blue. It is evident that chemical and not merely physical change has taken place, but to what extent the change can be regarded simply as oxidation is doubtful from the results on fabric after such short exposures.

It is probable that Harrison solution would be valuable for measuring the reducing power of a modified cellulose when only small samples of material are available.

The viscosity method appears to be suitable for investigating the effect on cotton of light of different wave-lengths. In the past attempts to find the region in the spectrum, which has the most deleterious effect have not met with much success, owing to the fact that the deterioration was measured by a relatively insensitive method, namely, the change in tensile strength. The authors hope to get more satisfactory results by using the viscosity method.

Tests, similar to those used in this paper, on fabric exposed in the absence of oxygen would show to what extent the change in the fabric, due to sunlight and air, is an oxidation process. Further work, however, on the quantitative use of Harrison's solution is necessary before it can be regarded as an entirely satisfactory method.

* Rewritten for publication.

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AMERICAN NATIONAL ADVISORY COMMITTEE REPORTS.

The National Advisory Committee for Aeronautics in the United States of America corresponds to our own Aeronautical Research Committee. Two distinct classes of reports are issued, the first being known as *Technical Reports*. These Technical Reports are printed, and are illustrated by photographs and/or drawings. The second class are known as *Technical Notes*, and are issued in mimeographed form so as to enable them to be rapidly distributed to a somewhat smaller, but directly interested, circle of readers. Copies of the Reports and Notes may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., U.S.A., but the American N.A.C.A. have a Technical Assistant in Europe, whose office is at 18, Rue Tilsitt, Paris, from whom copies can usually be obtained, thus saving a certain amount of time.

The average price of the Technical Reports is 10 cents, which is, of course, remarkably cheap in view of the information contained, and in some instances the price is as low as 5 cents.

Summaries of Technical Reports Published in 1926.

TESTS ON AIRPLANE FUSELAGES, FLOATS AND HULLS.—REPORT No. 236.

By WALTER S. DIEHL, Bureau of Aeronautics, Navy Department.

This report is a compilation of test data on airplane fuselages, nacelles, airship cars, seaplane floats, and seaplane hulls, prepared by the Bureau of Aeronautics at the request of the National Advisory Committee for Aeronautics. The discussion of the data includes the derivation of a scale correction curve to be used in obtaining the full-scale drag. Composite curves of drag and L/D for floats and hulls are also given.

THE EFFECT OF FLIGHT PATH INCLINATION ON AIRPLANE VELOCITY.—REPORT No. 238.

By WALTER S. DIEHL, Bureau of Aeronautics.

This report was prepared at the request of the National Advisory Committee for Aeronautics in order to supply a systematic study of the relations between the flight velocity V and its horizontal component V_H in power glides. Curves of V and V_H plotted against the inclination of the flight path θ are given, together with curves which show the maximum values of V_H and the corresponding values of θ. Curves are also given showing the effect of small departures from the horizontal in high speed performance testing.

METEOROLOGICAL CONDITIONS ALONG AIRWAYS.—REPORT No. 245.

By W. R. GREGG, Weather Bureau.

This report was prepared at the suggestion of, and for publication by, the National Advisory Committee for Aeronautics, and is an attempt to show the kind of meteorological information that is needed, and is in part available, for the purpose of determining operating conditions along airways. In general, the same factors affect these operating conditions along *all* airways though in varying degree, depending upon their topographic, geographic, and other characteristics; but in order to bring out as clearly as possible the nature of the data available, a specific example is taken, that of the Chicago-Fort Worth Airway on which *regular flying begins this year*.

TECHNICAL NOTES.

PROPELLER DESIGN: PRACTICAL APPLICATION OF THE BLADE ELEMENT THEORY—I.—No. 235.

By FRED E. WEICK, Langley Memorial Aeronautical Laboratory.

This report is the first of a series of four on propeller design, and contains a description of the blade element or modified Drzewiecke theory as used in the Bureau of Aeronautics, U.S. Navy Department. Blade interference corrections are used which were taken from R. & M. No. 639 of the British Advisory Committee for Aeronautics. The airfoil characteristics used were obtained from tests of model propellers, not from tests of model wings.

A short method is also shown in which the forces on only one blade element are considered in order to obtain the characteristics of the whole propeller.

The methods described have proved satisfactory in use.

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

THE 1927 MODEL "MOTH"

More Powerful Engine and Many Refinements Incorporated

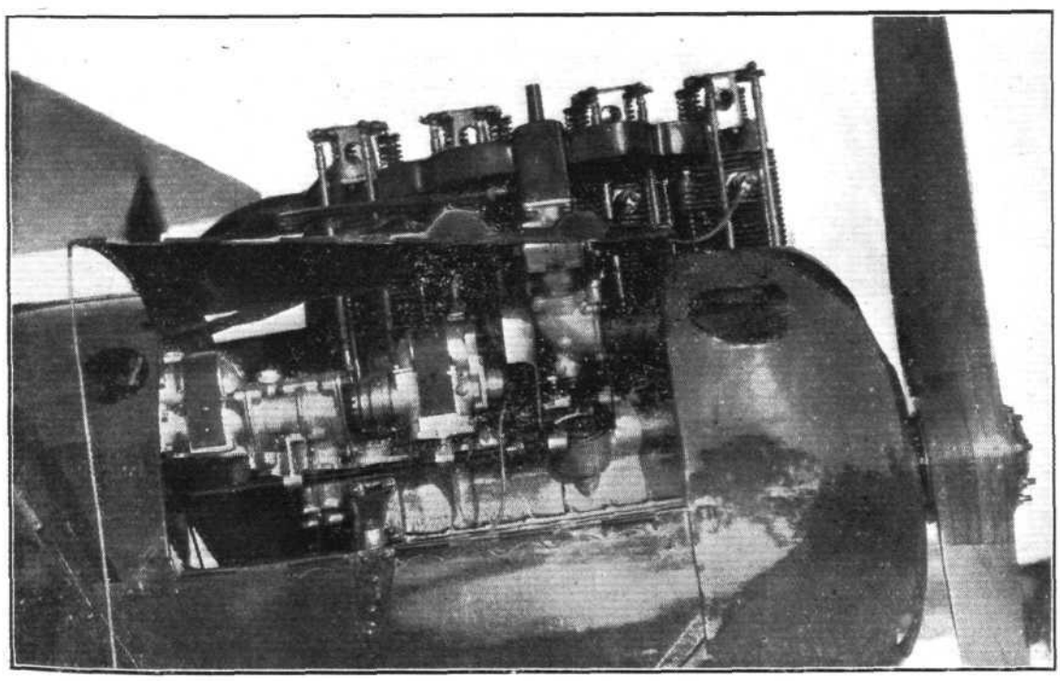
FOR the first time in the history of aviation, at any rate in the history of British aviation, it has become possible to speak of a new "model" of an aeroplane, in the sense in which the word is used in connection with motor cars, and not as we generally use it in connection with aviation. The de Havilland "Moth" has now reached a stage when it is not a question of a machine that will do its job with an engine of such and such a power, but of what sort of little comforts, what minor refinements, what colour schemes, etc., would the purchaser like. That in itself marks, we think, a definite step in the evolution of the private owner's aeroplane. The de Havilland "Moth" started life with the advantage of lines pleasing to the eye, and in that respect it has remained unchanged. In many details, important to the machine as an aeroplane, and others of value more from the user's point of view, the process of evolution has been at work, with the net result that the 1927 "Moth" marks a very considerable advance on earlier models. Yet this general improvement has not been accompanied by an increase in cost. In fact, exactly the reverse has happened, and the machine is being marketed this year at a price of £730.

Taking improvements first, perhaps the greatest change in the 1927 "Moth" is the fitting as standard of the new "Cirrus" Mark II engine in place of the Mark I fitted on the old model. The new engine (which was described and illustrated in FLIGHT of November 11, 1926) is slightly lighter in weight than the Mark I, but its power output is considerably greater, and there is no reason to doubt that the enviable reputation for reliability established by the older model will be worthily maintained by the new. The extra power is naturally reflected in the performance of the 1927 "Moth," which is considerably better than that of the Mark I engined type. Thus the following performance figures are guaranteed: Top speed, 98 m.p.h. (158 km./h.); cruising speed, 75-80 m.p.h. (120-130 km./h.); rate of climb at ground level,



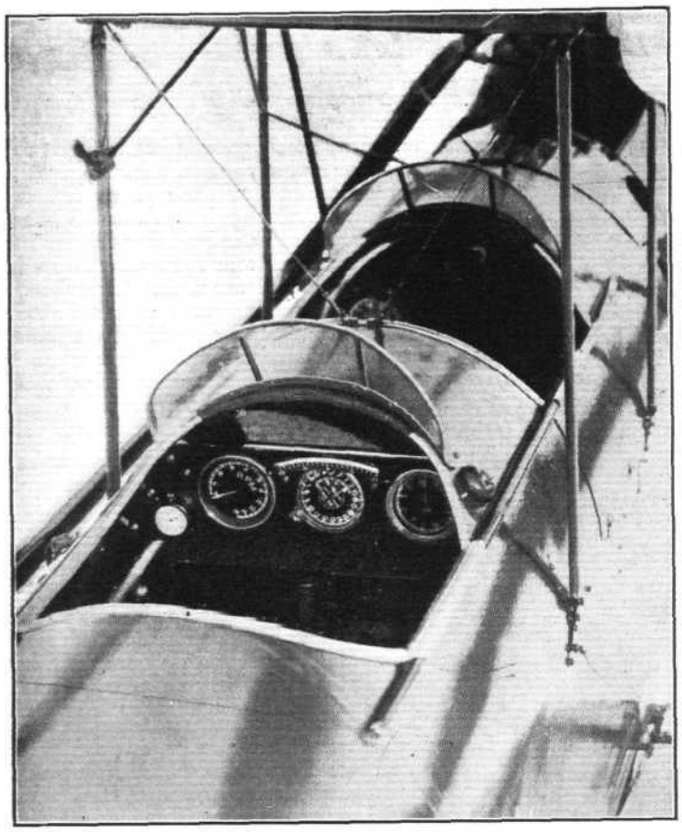
["FLIGHT" *Photograph*

THE 1927 MODEL "MOTH": This three-quarter front view shows the type of machine that has been standardised for the present year, and which incorporates several refinements.



The 1927 Model "Moth": The Mark II "Cirrus" engine is very accessibly mounted, as this photograph of the nose with cowling raised indicates. Note the new induction manifold.

["FLIGHT" *Photograph*



["FLIGHT" *Photograph*

THE 1927 MODEL "MOTH": View into the cockpit showing the new instrument board. The wind screens illustrated are the old type, and will be supplanted by a later pattern.

625 ft. per min. (3·18 m. per sec.); ceiling, 15,000 ft. (4,570 m.). These performances relate to a total loaded weight of 1,265 lb. (575 kg.). At the same time the machine is very economical in fuel and oil, the average mileage being 20 miles per gallon (2·8 litres per kilometre). The oil consumption is only 1 pint (about 0·5 litre) per hour. Mention should also be made of the fact that the "Cirrus" engine runs perfectly on ordinary petrol as obtainable at any garage, so that the private owner need never worry about his fuel supplies. This has been well demonstrated during the flight of Stack and Leete to Karachi, which was carried out on any petrol available along the route.

Statistics compiled from data relating to the flying of "Moths" over something like three-quarters of a million miles show that the cost of upkeep of the machine is, on an average, but a fraction of a penny per mile, this being a result of the special form of construction employed, which is of simple form and very robust.

Of minor improvements mention should be made of the greater comfort of the cockpits, a more artistic lay-out, with instrument board finished in dull cellulose finish, a small pocket above the dashboard for the stowage of gloves, pipes, maps, and even—yes, why not?—powder puffs. The luggage compartment behind the aft cockpit now opens into the cockpit itself, and does not have a "hatch" in the deck, as it was found that users sometimes forgot to fasten this, with the result that it flew open when the machine was in the air, although there is no record of week-end cases having been deposited on unsuspecting victims below. A new type of windscreen is being fitted, although those shown in our photographs are, it should be pointed out, of the old pattern. Altogether the 1927 "Moth" is a thoroughly "eyeable" machine, apart from its robustness and reliability, and the factor which it is so important to cultivate in the case of automobiles: pride of ownership, can very justly be applied to the first British standardised private aeroplane.

As regards the question of cost, the price reduction has been made possible by putting the "Moth" on a quantity production basis. Not, of course, on the scale that automobiles are produced in quantities, but by making a close study of details and setting a shop aside entirely for the production of "Moths." Somewhat elaborate jigs have been made which facilitate the construction of the fuselage, the sides, top and bottom being erected on one of these jigs, the complete fuselage shell leaving the jig absolutely accurate and ready to have the controls, seats, engine mounting, etc., installed. The de Havilland works even boast a chute for the rapid transport of parts from stores to erecting shop. Doubtless the endless belt conveyor will come in time!

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Air Progress in South Africa

THE Union of South Africa is now negotiating for the establishment of an air mail service which will primarily shorten the journey for mails between the Cape and England by four days. At the moment it is their intention to link Walfish Bay, the chief port of the mandated territories of South-West Africa, with all the chief towns, like Cape Town, Johannesburg, Durban and Pretoria, whilst a future extension would reach through the whole of Africa to Cairo. By selecting Walfish Bay as the point of departure and arrival for all mails it will mean a later outgoing mail and an earlier incoming mail, for it is approximately 850 miles north of Cape Town by sea, where the mails are now distributed. The proposed route from the Bay to Johannesburg, Pretoria and Durban would cross the late German South-West Africa, the great Kalahari Desert, and vast stretches of veldt, partly covered with bush and quite dry, in Bechuanaland. Stops would be made at Rehoboth (165 miles), Matsa (310 miles), and Munguaban (260 miles); and Johannesburg reached in 12 hours, a total of 900 miles. Durban would be reached in the evening about 9.40, a further flight of 330 miles. From the terminus of Johannesburg the flight south to Cape Town would be approximately 800 miles, with a stop at Bloemfontein. There are many difficulties at the moment clogging the project and one is the extra subsidy asked by the Union Castle Line for the additional expense they would incur by diverting their course to Walfish Bay to pick up the mails. Negotiations are pending, and it is thought that in the event of failure an alternative will be instituting a seaplane service to meet the liners on the high seas at a point 100 miles west of Swakopmund, higher up the coast. It is a question of which is the cheapest method. The whole contract is to be given to an air combine subsidised with £8,000 a year, and there is a fear that the German Junker firm, who are stated to be firmly established in South Africa and engaged in a widespread constructional campaign, will receive it instead of a British firm. Some time ago, before these Government plans were less matured, Imperial Airways considered the contract but came to the conclusion the subsidy was not sufficient. The Walfish Bay project was not mentioned then. It is rumoured that a Maj. Miller, a member of the Union Legislative Assembly, has raised £35,000 in Great Britain and America to open passenger services between Johannesburg and Durban, and that these will be running in a few months. The fare for the 330 miles flight is proposed to be £7 10*s*. It is suggested that this service will thus qualify for the Government subsidy, £8,000.

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Sir Charles Wakefield Scholarship and Hyde-Thompson Memorial Prize

AIRCRAFT apprentices F. C. Sturgiss, J. D. Rutherford, and W. R. Beaman, from No. 1 School of Technical Training (Apprentices), Halton, and Aircraft Apprentice T. Shelley, from the Electrical and Wireless School, Flowerdown, have been selected for cadetships at the Royal Air Force Cadet College, Cranwell, on the results of the examinations held on completion of their three years' training as aircraft apprentices. "Sir Charles Wakefield" Scholarships, valued at £75 each, have been awarded to Flight-Cadet J. G. W. Weston on the result of the recent competitive examination for entry into the Royal Air Force Cadet College and to Flight-Cadet F. C. Sturgiss. The "Hyde-Thompson" Memorial Prize, valued at about £33, has been awarded to Flight Cadet T. Shelley.

Prime Minister Visits Northolt

ON Monday last, the Prime Minister, in company with Marshal Sir Hugh Trenchard and Air-Marshal Sir John Salmond, paid a visit to No. 41 Fighter Squadron, R.A.F., at Northolt. After lunching with Sq.-Ldr. T. Sowrey, D.S.O., M.C., and the other officers of the Squadron, Mr. Baldwin witnessed some excellent formation flying by the Squadron on their "Siskins."

H.M. Aircraft-Carrier "Argus"

THE Aircraft-Carrier "Argus" has now been recommissioned for service after a refit begun in November, 1925.

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

"AVIATION" AT R.AE.C. MONTHLY HOUSE DINNER

THE Monthly House Dinner of the Royal Aero Club, was held on January 19. The chairman, Mr. T. O. M. Sopwith, opened the after-dinner discussion on "Aviation," by regretting the unavoidable absence of Lord Thomson, and introducing a distinguished guest, Air Vice-Marshal Sir J. F. A. Higgins, K.B.E., C.B., D.S.O., A.F.C., late Air Officer Commanding Iraq. Sir John, he said, was the first man in the world to have the responsibility of running a country from the air. He had ruled Iraq with more humanity and less suffering than any army could have done. In his new work, Sir John would be equally successful and always ready to give his utmost help in any way for the advantage of the aircraft industry. Introducing Mr. Fairey, the Chairman regretted that he was handicapped with a cold on the chest.

Mr. Fairey discussed "Aviation" in a very interesting and thorough way. He said he had been frank and had suffered for his frankness. He referred to his previous speech on American aviation, as a result of which he had been termed pro-American. A man was expected to make a conventional, standardised speech in this country, otherwise he was a "Red," or what Mr. Lansbury would term "hardfaced." Well, it was better to be that than sloppy-faced. He was not going to make a standardised speech. Although it was unsafe to "shoot the line" in aviation, still, at these dinners, which were like family affairs, he thought a man should speak his mind. Mr. Fairey said he was strongly opposed to Internationalism. He thought it meant stagnation to flying in this country. Take private flying. What progress was it making? None. It was restrictions that were strangling it. The Aero Club should put forward strong demands to abolish these, but there came the shock. The Air Ministry would meet them up to a point, but they would discover a greater and more impregnable power than the Air Ministry, the International Convention of Aerial Navigation. This was formed in 1918, by the Allied Powers at a time of high post-war optimism, and their first manifestations were comparatively harmless. They introduced registration of aircraft and rules of the air that were essential, but then they did not stop at that and went far beyond the bounds of all reason. They embraced the design and constructional aspects and destroyed all æsthetic considerations. A designer could not make his machine beautiful with fine graceful outlines. The surface of his wings had to be obliterated by huge, ugly, square letters of registration, which could not be seen at a thousand feet. Could anything be more ridiculous? Obviously, no artist sat on the Convention. Yet it had its humorous side, apparently, for he (Mr. Fairey) had seen a machine with "O— BABY" painted on it. He supposed it possible to happen that when Edwin came to take Angelina for a flight, he would discover his machine christened "Gertie." He compared the situation of cars. If cars were forced to be made ugly, would they sell? Then, why should ugly aeroplanes sell? The registration of machines and the rules of the air was the legitimate function of the I.C.A.N., but we must look up if they were to intervene in aspects beyond that. They must not touch design. They must not destroy beauty. Why was it a necessity in private flying to have an airworthy certificate? If this was absolutely necessary, would not many famous flights never have happened? Could Sir Alan Cobham have made his recent flight to Australia without obviously obtaining concessions? Did he not of necessity carry a greater load than the restrictions would normally allow him? This work of the I.C.A.N. was internationalism leading to a standardisation for all world aircraft, and he was strongly opposed to conforming to the ideas of European countries. Let each country progress in its own way. What had we to gain by standardisation? What could Germany teach us? Or France? He believed in following the policy of isolation from Europe, and looking to our own Dominions, which offered far greater scope than anywhere in the world. The markets of Europe might have been much to us in the past, but now they were dead, and would remain dead in the future. He was convinced of that. To follow our own path essentially meant to defend ourselves, and that led to comments on our Air Force. At first, this country approved of 52 squadrons as the essential minimum. The Labour Government came and approved of that, too; then the Conservatives came into power again, agreed at first to 52 squadrons, and then decided that half that number would do. So to-day, we had half the defence at one time considered the absolute minimum, and we relied for our safety on the Locarno spirit in our neighbours. The isolation of this country had been made impregnable in the past by our Navy, but now it was absolutely defenceless against air attack, and would be till we got back our 52 squadrons. The time of this gathering at dinner would not be wasted if they all worked for that end.

The Chairman, expressing the general gratitude to Mr. Fairey, said that none had been so fair and done so well. He was afraid Mr. Fairey, however, had been preaching to the converted, but he only wished that it had been broadcast to the whole country. Colonel Bristow agreed with Mr. Sopwith, and then commented on certain points in the discussion, during which he revealed the amazing official orders once existing in his knowledge, which insisted that all aircraft in flight should give a warning of three loud toots on a horn or something like that when passing each other. This story received a well-merited humorous response. Private flying in this country was very small, he said, and it was entirely due to restrictions enforced. He compared it to the comparative freedom of motor-cycles, which on all statistics proved far more dangerous to the public than aeroplanes. Yet, any minute in the street you were in danger of being pushed through a plate-glass window by a driver who might be deaf, blind, dumb, and have only one arm or leg, driving a cycle whose steering bars had never had to have a certificate of worthiness. Incidentally, he revealed the fact that the registration of aircraft had been enforced largely through the demands of the wireless people, who apparently found the present system necessary.

Mr. Bramson said that his pet subject was on educating the public to the safety of flying. That was the only solution of the problem. The Club smilingly agreed with him. He had an idea that Mr. Fairey might be contemplating producing machines on the instalment plan; if it was so he would be pleased to buy one.

Mr. Handley Page hesitated to speak in such a distinguished gathering but in his usual inimical way he followed on the serious discussion and ended with an unexpected but characteristic climax. He thought that one future subject for discussion should be on the excellent quality of the food at the Club dinners, and he appropriately proposed that Mr. Frisby, the caterer, should be called upon to open that discussion. He had been accused, he said, of being opposed to the progress of airships. He would like to dispel that illusion. At the time of the Italian flight by airship across the Pole Commander Boothby had approached him for his interest and help to build a ship for the same purpose. With the usual generosity of aircraft people he had contributed, but he had never had a receipt that he knew for the sum given. That showed he was not opposed to airships. Incidentally he had recently learned that he was the only contributor to the project and his contribution was a halfpenny! His serious sentences were in defence of less abuse of the Air Ministry, which represented the dull, unprogressive, British mind, and doing more for ourselves. Encourage private enterprise. That alone was responsible for the developments today. The greatest flights in history, the Atlantic, for instance, were all made by private enterprise. Let that be our policy. We ourselves must make the world look to England for its aircraft and not crush our individuality under the steam roller of Internationalism.

Captain Sayers did not agree with the policy of isolation. He liked the German, he said, although he did not approve of German rule, or the monopoly of one country over another. The position in this country was that any man could design and build a machine but he could not fly it. Restrictions there intervened and he would find, after considerable trouble, that these were in the hands of the I.C.A.N. Today safety first was on the brain. We must alter that for it spread stagnation. All aviation had progressed by risking nine times out of ten. Risk won the war and it would win the peace, too.

Col. Darby rose and thought that the Air Ministry was efficient but not ambitious. Mr. Fairey was right on the interference of the I.C.A.N., and he thought that that body should always consult an expert before acting.

Mr. Colebrook then said that he was opposed to Mr. Fairey. We could not afford to be independent. We had not the wealth to raise a regular air defence to make us invulnerable. We would always have to depend on Europe to some extent. The Locarno spirit was necessary for the future prosperity. He agreed that it was not advisable the I.C.A.N. should be controlled by a foreign body.

When Major Buchanan rose he first made it clear that he was speaking as an ordinary member of the club and not in an

official capacity. The outcry against control and restrictions had some foundation for it but at the same the country would not tolerate all absence of control of aircraft, and the Air Ministry after all was the representative of the public. Private flying should be quite separated from commercial flying. He thought we had nothing to fear from isolation. We had the supremacy of the world in aircraft. Therefore independence could not harm us.

Captain Lamplugh spoke on insurance. In this, we in England were far more progressive than any other country. The insurance rates for aerial passengers and goods were the lowest in the world, which was a good sign.

The Chairman, in passing a vote of thanks to Mr. Fairey, said that he had never seen a lecture taken up so thoroughly.

Captain Barnard, of Imperial Airways, passed a vote of thanks to Mr. Sopwith and congratulated him on the warlike spirit he had enthused into the discussion amongst so peaceful a gathering.

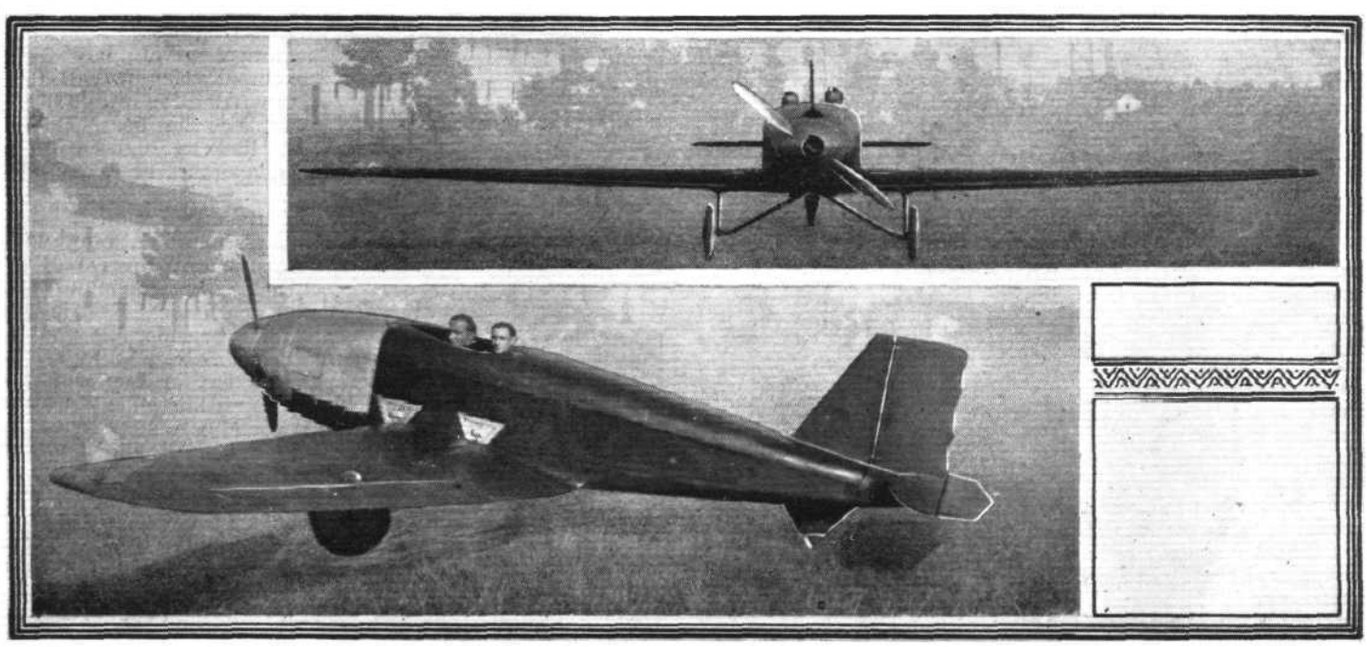
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OIL COOLING

THE first informal discussion of the Royal Aeronautical Society was held in the library of the Society at 7, Albemarle Street, on January 18, The Chairman, Col. The Master of Sempill, A.F.C., introduced the lecturer, Mr. A. H. R. Fedden, of the Bristol Aeroplane Co., designer of the "Jupiter," whose subject was "Oil Cooling." Mr. Fedden expressed the fear that his paper was not so complete as he had intended, owing to the interruptions of business, but for all that, for 15 mins. he dealt very thoroughly and interestingly with the general aspects of his subject. Oil cooling, he said, was necessary with the modern high-powered engines, but the difficulty was to cool the oil with the high temperatures developed. There were two methods of installation, the internal, which gave a rise in temperature, and the external, which gave a drop in temperature. He thought that the quantity of oil used through the cooler had no effect on the temperature. It was the cooling area that was the important factor. There should be two thermometers, one for the return reading and the other for recording the high temperature of the engine and not the oil. Castrol oil was the best to use, and the feed at 50° to 60° was desirable. In a test when an engine ran for 150 hours, the oil temperature was 105°, and the bearings were quite sound. As regards the types most suitable for oil cooling, there a difficulty arose. It was really impossible to produce a standard cooler for, essentially, it would not be adaptable to all machines. Really to obtain the greatest efficiency, each type of aircraft should have its own designed cooler. The Bristol Company made three types. The drag in each was kept as low as possible. The first, for high-speed engines, weighed 3¼ lbs., the frontal area was 3·5 sq. ins. and the drop in temperature was 26°. The second type figures were, 5¼ lbs., 7 sq. ins. and 39° temp.; the third, 8½ lbs., 17 sq. ins. and 45° temp. The Gnome-Rhone Company had an oil cooler with a 27° drop in temperature. Mr. Fedden mentioned that he had been trying to obtain an empirical formula for a cooler, but he could give no particulars then. He thought that progress in design generally would benefit greatly if considerable tests and experiments were made by the Air Ministry at Farnborough. Wind tunnel tests should be tried, to obtain the drag and efficiency; and oils should be tested. As the situation was now, designers had very little data on results of coolers in use.

Following Mr. Fedden's lecture, there was an interesting debate led by Dr. Thole, head of the Engine Research Branch, Anglo-Persian Oil Co., Mr. Pierson, of Vickers, Ltd., and Major Halford, designer of the "Cirrus." The question of positions of coolers, and various theories for obtaining quickest cooling were raised. It was suggested that installation on the leading edge gave a minimum drag, and Mr. Fedden agreed that results had been successful, but there again he said the difficulty arose of the position being unadaptable for a standardised cooler. The theory of another debater on the cooling was that turbulences in the oil flow gave greater cooling effects, rather than the increase of the tubes. Increasing the length of the tubes increased the temperature, whereas an increased oil flow speed lowered the temperature. The practice in oil coolers for other purposes than aircraft, of a twisted bar through the tube to break up the oil volume, was mentioned. A speaker thought there were no means of knowing instantly when the temperature of the oil was too high, as in the case of water cooling where the water boiled and made steam.

Mr. Fedden, in replying to the questions, mentioned that cooling was not so efficient with pure mineral oil as with blended oil, but the former was used as the after running effects of the latter were not so satisfactory. He said that large quantities of oil through the cooler only became cooled in small amounts. On the matter of design, a cooler was required which combined greater cooling effect with a drop in drag. He had received particulars of an experiment carried out by Mr. North in a wind tunnel. The cooler was ¾ lbs. drag at 100 ft. per sec. Col. Bristow had designed a cooler in which oil was blown in a fine film over a large area. Its defect was the complication of the design. The Chairman then called upon Mr. Handley Page to make comment on the subject, but Mr. Page pleasantly excused himself on the plea that he had not heard all the lecture, through his late arrival; he would confine himself to calling for a vote of thanks to Mr. Fedden, which was heartily accorded.



AN ITALIAN LIGHT 'PLANE: Two views of the C.F.2 two-seater designed and constructed by Costruzioni Aeronautiche Italiane of Milan. The machine is fitted with an engine of 40 h.p., and it will be seen that it is of the side-by-side type. The wing span is 12·5 m. (41 ft.) and the wing area 14 sq. m. (151 sq. ft.). The loaded weight is 470 kg. (1,035 lbs.), and the maximum speed 125 km. per hour (78 m.p.h.).

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

THE ROYAL AIR FORCE

London Gazette, January 18, 1927.

General Duties Branch

Flight Cadet W. J. H. Lindley having successfully passed through the R.A.F. Cadet College, Cranwell, is granted a permanent commn. as Pilot Officer on probation, with effect from, and with seniority of, Dec. 11, 1926; Sub-Lieut. J. E. Burstall, R.N., is granted a temp. commn. as Flying Officer on attachment for four years' duty with R.A.F.; Jan. 4. The following Pilot Officers are promoted to rank of Flying Officer:—H. A. Evans-Evans; Sept. 7, 1926. A. H. Willetts; Nov. 16, 1926. G. J. C. Mahony; Nov. 30, 1926. C. Heard-White; Dec. 14, 1926. Pilot Officer on probation R. A. Barnett is confirmed in rank; Jan. 4. Flight-Lieut. A. J. G. Styran, M.C., A.F.C. (Lieut., R.A., R.A.R.O.), is transferred to Reserve, Class A; Jan. 18. Flying Officer E. R. Newbigging (Lieut., T.A. Reserve, General List, R.A.S.C.) relinquishes his short-service commn. on account of ill-health; Jan. 16. D. H. Tollemache (Lieut. (E.), R.N., Flying Officer, R.A.F.) relinquishes his temp. commn. on return to naval duty; Jan. 11. Flying Officer W. J. Eldridge, D.S.O., M.C. (Lieut., R.A.), relinquishes his temp. commn. on return to Army duty; Jan. 12. The following Pilot Officers on probation resign their short-service commns.:—K. R. Soward; Jan. 12. A. D. Vigors; Jan. 19.

Accountant Branch

The following Pilot Officers on probation are confirmed in rank and are promoted to rank of Flying Officer (Dec. 7, 1926):—D. Sender, J. A. Stephenson.

Medical Branch

The following are granted short-service commns. as Flying Officers, for three years on active list, with effect from, and with seniority of, Jan. 4:—J. E. Foran, M.B.; M. O'Regan.

Memorandum

The permission granted to Lieut. H. S. Newman to retain rank is withdrawn on his enlistment in the Territorial Army; Dec. 1, 1926.

Reserve of Air Force Officers

The following are confirmed in rank:—*Flying Officer on probation:* S. Turner; Jan. 13. *Pilot Officers on probation:* J. R. W. Alexander; Jan. 13. J. H. A. Wells; Jan. 18. N. M. Browning; Jan. 19. H. A. Denny; Jan. 20.

Flying Officer A. C. W. Richards is transferred from Class C to Class A, No. 16, 1926. The following Flying Officers are transferred from Class B to Class C:—A. A. W. Barron; Oct. 24, 1926. H. Alexander; Dec. 12, 1926.

Flying Officer G. S. Fenwick relinquishes his commn. on account of ill-health, and is permitted to retain his rank; Jan. 19.

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

Flying Officers: R. S. Blucke, C. R. Mason, E. C. G. Badcock and J. W. Vanderbeeck, to Elec. and Wireless Sch., Flowerdown; 10.1.27. M. B. Mackay, to Armament and Gunnery Sch., Eastchurch, on transfer to Home Estabt.; 18.1.27. G. G. Mobsby, to R.A.F. Depot, Uxbridge, on transfer to Home Estabt.; 26.12.26. E. Parrett, to No. 1 Sch. of Tech. Training (Apprentices), Halton; 17.1.27. M. C. Dudding, to Sch. of Photography, South Farnborough; 20.1.27. M. V. Ward, to R.A.F. Training Base, Leuchars; 25.1.27. (Hon. Flight-Lieut.) R. F. Carter, to R.A.F. Training Base, Leuchars; 21.1.27. J. A. T. Ryde, to R.A.F. Training Base, Leuchars; 7.1.27. R. F. Francis, to No. 481 Flight, Mediterranean; 4.1.27.

Pilot Officers.—J. F. Griffiths, to No. 24 Sqdn., Kenley, on appointment to a Short Service Commn., 3.12.26. W. M. C. Kennedy, to No. 58 Sqdn., Worthy Down, 4.1.27. J. G. D. Armour, to Central Flying Sch., Wittering, 4.1.27. E. B. Steedman, to No. 1 Flying Training Sch., Netheravon, 4.1.27.

Pilot Officers: A. R. S. Davies, R. F. Gandy, L. L. K. Honeyball, J. B. Knapp, A. McKee, J. H. L. Maund, P. C. Miller, H. F. Suren, F. J. Taylor, C. K. Turner and J. W. Wood, to R.A.F. Depot, Uxbridge, on appointment to Short Service Commns. (on probation); 4.1.27.

The following Pilot Officers are all posted on appointment to Permanent Commns. from R.A.F. Cadet College, Cranwell, with effect 11.12.26:—

J. Clarke, to No. 29 Sqdn., Duxford; W. C. Cooper, T. C. Dickens and C. W. Dicken, to No. 9 Sqdn. Manston; J. C. A. Johnson, A. M. Watts-Read and J. Marson, to No. 13 Sqdn., Andover; V. Q. Blackden and B. M. Cary, to No. 2 Sqdn., Manston; J. Norwood, to No. 23 Sqdn., Henlow; P. McG. Watt and P. C. I. Elderton, to No. 17 Sqdn., Upavon; W. N. Blain, E. C. Lewis, P. L. A. Berthon and R. P. Teale, to No. 19 Sqdn., Duxford; R. J. D. Brown, to R.A.F. Base, Gosport; G. Francis, G. I. L. Saye and A. R. Sarel, to R.A.F. Base, Calshot; V. B. J. Jackson and T. J. Arbuthnot, to No. 41 Sqdn., Northolt; H. B. Maughan, to No. 99 Sqdn., Bircham Newton; G. F. Lewis, P. L. P. Marett and W. J. H. Lindley, to No. 3 Sqdn., Upavon; G. F. Whistondale, to No. 12 Sqdn., Andover.

E. M. Thompson and J. B. M. Wallis, to R.A.F. Training Base, Leuchars; 17.1.27.

NAVAL APPOINTMENTS

The following appointments have been made by the Admiralty:—

Commr. E. T. R. Chambers, A.F.C., appt. to Senior Officers' Technical Course cancelled.

Lieut.-Commrs.: G. C. E. Hampden, to *President* for duty in Naval Air Section, temp.; 10.1.27. G. M. B. Langley, to *President*, addl., for course of instruction in meteorology under R.A.F.; 12.1.27.

Lieuts. (F.O., R.A.F.): H. L. St. J. Fancourt, R. A. Peyton, E. E. Blackwell, A. A. Murray, and N. R. Courthope-Munroe, to *Argus* and for full flying duties in 422 Flight, on commg.; 19.1.27. J. W. M. Healing, A. N. R. Keene and J. W. Hawkins, to *Argus* and for deck-landing training in 422 Flight, on commg.; 19.1.27.

Lieut., E. (F.O., R.A.F.): D. H. Tollemache, to *Furious*; 11.1.27.

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LIGHT 'PLANE CLUB DOINGS

London Aeroplane Club

FLYING during the week was restricted to two days, owing to snow, rain and fog. The total flying time was 11 hrs. 55 mins. The following Members had flying instruction:—D. S. Hewitt, A. J. Richardson, H. Solomon, F. T. Stephens, J. J. Hofer, C. R. Campkin, A. E. Leeding, C. H. Swan, E. A. Lingard, G. N. Howe, Lady Bailey, M. P. Susman.

The following Members flew solo:—Lady Bailey, H. Solomon, C. E. Murrell. The following Member had a joy-ride:—The Hon. R. Westenra.

All four machines are now in commission again.

The Hampshire Aeroplane Club

REPORT for week ending January 21:—Total flying time, 14 hrs. 20 mins.; instruction flying, 8 hrs. 45 mins.; passenger flying, 1 hr. 25 mins.; solo flying, 3 hrs. 10 mins.; test flights, 1 hr.

The following members had instruction:—Lieut. Heinemann, R.N., 3 hrs. 40 mins.; Senor de la Cierva, 2 hrs. 15 mins.; Lieut. Cadell, R.N., 40 mins.; Hon. H. R. Grosvenor, 35 mins.; Mr. Dobson, 35 mins.; Mr. E. V. Somerset, 30 mins.; Mr. Stokes, 15 mins.; Mr. Courtney, 15 mins.

The following members had joy rides:—Mrs. C. B. Fry, Mrs. Scott, Mr. Scott, Mr. Molyneux, and Dr. Roberts.

The soloists were:—Mr. O. E. Simmonds, 1 hr.; Mr. S. Fry, 35 mins.; Mr. Keeping, 30 mins.; Mr. Nicholson, 20 mins.; Mr. Rumble, 20 mins.; Mr. Bowen, 15 mins.; Senor de la Cierva, 5 mins.; Lieut. Heinemann, R.N., 5 mins.

On Thursday two more pupils made their first solo flights, viz., Senor de la Cierva and Lieut. Heinemann, R.N., and both were up to the usual high standard of the Hampshire Aeroplane Club.

Senor Cierva taught himself to fly ten years ago, and flew solo about three hours in all, since when he has not touched a "joystick" till Thomson has taken him in hand. After 2½ hours' dual with Thomson, however, Cierva felt as safe in the air as if he were in his Autogiro—and was sent solo!

Now that Mr. Simmonds has his "A" licence, he is putting in good work carrying passengers during week-ends, when Capt. Thomson is instructing, and last Sunday he gave Dr. Roberts an hour's joy riding.

Lancashire Aero Club

REPORT for week ending January 22.—Total flying time for the week 10 hrs. 25 mins. made up as follows:—

Dual with Mr. Brown:—Messrs. Crosthwaite, 55 mins.; Dickinson, 40 mins.; Gattrell, 50 mins.; Forshaw, 30 mins.; Newton, 35 mins.; Keays, Meades and Nelson, 25 mins. each; Costa, 15 mins.

Solo:—Messrs. Michelson, 1 hr.; Slater, 50 mins.; Twemlow, 50 mins.; Hardy, 15 mins.; Williams, 10 mins.; Crosthwaite, 10 mins.

Joy-rides:—With Mr. Costa: Mr. Gouto, 30 mins.; with Mr. Cantrill: Mr. Hill, 25 mins.; with Mr. Lacayo: Mr. Dean, 15 mins. Test flights, 1 hr.

Splendid ski-ing weather has prevailed during the latter part of the week and the central skid in the Avro undercarriages has proved most useful in taking off and landing. The "Moths," being without this valuable attachment, found the snow too deep for them by Saturday and had to sulk on the deck.

Undeterred by the polar conditions, Mr. Crosthwaite made his first solo during the week and put up a very nice show.

By Sunday afternoon the thaw had progressed far enough to let the two serviceable "Moths," LR and MQ, get off the ground once more. Unfortunately, their enforced idleness had rendered them a bit skittish, and they promptly proceeded to butt one another in the ribs, so to speak, in a playful manner. The result reminded one of the old riddle about "Why is a Moth fluttering round a candle like a gate?" the answer being that "If it keeps on it's 'inges it swings."

Midland Aero Club, Ltd.

REPORT for week ending January 22.—The total flying time was 11 hrs. 54 mins.

The following members were given dual instruction by F/O Glover:—C. Fellowes, A. Ellison, S. H. Smith, J. C. Rowlands, G. H. Aldridge, F. Coxhill.

Secondary dual:—A. B. Gibbons. Advanced dual:—R. L. Jackson, W. Swann.

The following "A" pilots made solo flights:—W. Swann, H. J. Willis, E. J. Brighton, R. L. Jackson.

Passengers with Mr. Brighton:—D. M. K. Marendaz, V. Horsley. Mr. Brighton flew the Austin "Whippet" for 2 hrs. 25 mins. during the week.

The Newcastle-upon-Tyne Aero Club

REPORT for week ending January 9.—Total time flown, 23 hrs. 25 mins. Dual 10 hrs. 15 mins. Solo (training), 35 mins. "A" Pilots, 9 hrs. 30 mins. Joy rides, 50 mins. Avro, 2 hrs. 15 mins.

The following flew under instruction with Mr. J. D. Parkinson:—

Miss Leathart, Messrs. Wardill, Turnbull, Stawart, A. Bell.

Mr. Mathews had secondary dual and Mr. H. Ellis advanced dual.

"A" Pilots who flew:—Mr. J. D. Irving, Mr. R. N. Thompson with Miss Douglas, Miss Skipley, Miss Wilson, Miss Cochran, and Miss Evervill. Mr. C. Thompson, with Mrs. Heslop and Mr. H. H. Leech. Mr. A. Bell was launched during the week.

The following flights were made on the Avro:—Mr. H. H. Leech with Mr. Gibson, Mr. W. Baxter Ellis with Miss Dunford, Mrs. Ellis and Mr. and Mrs. Morgan, Mr. P. Forsyth Heppell with Mr. Thirlwell and Mr. H. Ellis, Mr. N. S. Todd with Mr. J. Bell and Mr. A. Bell. Mr. Parkinson also carried out some tests and joy rides.

REPORT for week ending January 16:—Total flying times 25 hrs. 40 mins. Dual instruction, 8 hrs. 50 mins. Solo (Training), 9 hrs. 45 mins. "A" Pilots, 5 hrs. 25 mins. Avro, 1 hr. 40 mins.

The following members flew under instruction:—Miss Leathart, Messrs. Bainbridge, Stawart, Wardill, Rasmussen, Turnbull.

Solo training:—Miss Leathart, Mr. Stawart, Mr. Mathews and Mr. A. Bell. Miss Lathart and Mr. Stawart were launched during the week.

"A" Pilots:—Lieut. A. P. C. Hannay, Mr. H. H. Leech, Mr. H. Ellis, Mr. J. D. Irving with Mr. Pike, Lord Ossulston with Mr. A. Bell, Mr. R. N. Thompson with Mr. H. Ellis, Mr. C. Thompson with Mrs. Heslo, Mr. R.N. Thompson with Mr. Brown, Mr. F. H. Phillips. Mr. J. D. Parkinson flew with Mr. Shaun Glenville as passenger.

Mr. Parkinson flew the Avro with the following among his passengers—Miss Kemp and Mr. L. M. Middleton, Mr. J. M. Kennedy, Mr. Meisegaes.

FLYING report for week ending January 23.—Total flying time 28 hrs. 35 mins. Moths—LX 22 hrs. 25 mins.; LY., 5 hrs. 25 mins.; Avro P.O., 45 mins.

Dual instruction with Mr. J. D. Parkinson, 3 hrs. 15 mins.

Solo (Training), 12 hrs. "A" Pilots, 5 hrs. 45 mins. Joyrides, 1 hr. 10 mins. Weather tests, 15 mins.

The following members flew under instruction:—Miss Leathart, Mr. Stawart, Mr. Wardill, Mr. Wilkinson, Mr. Jackson, Mr. Rasmussen, Mr. Turnbull and A. Bell.

Advanced dual, Mr. Irving, Mr. C. Thompson, Mr. H. Ellis.

Solo, Miss Leathart, Mr. Stawart, Mr. Mathews and A. Bell.

"A" Pilots:—Mr. Irving, Mr. R. N. Thompson, with the following passengers:—Mr. J. Bolt, Mr. R. Stephenson, Mr. H. Ellis.

Mr. H. Ellis flew with Mr. Thompson and Mr. Percy as passengers. Mr. C. Thompson with Mr. Heslop. Mr. Baxter Ellis also carried some friends as passengers.

Mr. Parkinson flew with the following as passengers:—Mr. Woodeson, Miss Davies, Miss Sawyers, Miss Southern.

Avro G-EBPO, Mr. Ellis flew with Dr. Bell and Mr. G. Ervin, and Mr. Parkinson with Mr. Phillips and Mr. Peacock.

Lord Ossulston and Mr. J. D. Irving collected LY from Stag Lane, where it has been under repairs, on Saturday. They were prevented by bad weather from leaving until 1.0 p.m., and flew for a considerable distance through snow storms, so decided to put down at Cranwell. They proceeded on Sunday, reaching Cramlington at 1.5 p.m., after anything but a pleasant journey. Lord Ossulston had arranged to lecture in Newcastle on Sunday evening, and desired to return to Chillingham Castle afterwards. There is, unfortunately, no telephonic communication with Chillingham on Sundays, so it was impossible to order a car to take him home. He therefore flew to Chillingham, landing on an aerodrome which he is having prepared for his own MOTH, ordered his car to meet him, and flew back to Cramlington, delivering his lecture "according to plan."

The aerodrome appeared very active on Sunday, with three machines flying, in spite of the cold, mist and snow, and creates promise of great activity when better weather conditions arrive.

The Yorkshire Aeroplane Club

REPORT for the week ending January 21.—The total time flown amounted to 5 hrs. 25 mins., as follows:—Solo, 2 hrs. 55 mins.; dual instruction, 2 hrs. 10 mins.; and Joyrides, 20 mins. Out of this total time, Sunday was responsible for 3 hrs. 50 mins. in 19 flights There were 26 flights altogether.

The following members flew solo:—Messrs. Carter, Dawson, Mann and Wood; while those who received instruction were Messrs. Gardner, Mann, Oglesby, Richardson and Swift. The joyriders were Mr. Bamford and his son, who are residents of Harrogate. It was their first experience in the air. Mr. Bambord, Senior, although well on in years, is contemplating joining the Club as a flying member.

On Sunday, Mr. Dawson flew over to his home at Nun Appleton Hall, York, to fetch a small cinema camera. On his return he and Mr. Mann treated us to a thrilling display of formation flying as they photographed each other from the air.

Our "A" Licence enthusiasts are still waiting patiently until Mr. Loton can come to observe the tests, although their chances of success during the last few days would have been none too rosy, the aerodrome having been covered with snow to a depth of several inches, with a considerable amount of ground mist.

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The History of Eastchurch

NONE of the British flying grounds have, we think, a more interesting record of the progress of flying in this country, from the very earliest, than has Eastchurch. Flying-Officer R. H. W. Empson, R.A.F., has written a history of this flying station which has been officially approved. Any of our readers who may be interested in this subject can obtain a copy of the book direct from F./O. R. H. W. Empson, R.A.F., Eastchurch, Kent. The price of this book is 9d. per copy, any profits obtained from its sale being forwarded to the R.A.F. Memorial Fund.

The "Gloster" Magazine

THE Gloster Aircraft Co., Ltd., of Cheltenham, published a short while back the January-February (Christmas double number) issue of that very successful house journal of theirs—the "Gloster." It is, perhaps, a little late in the year to refer to Christmas (last) numbers, but pressure on our space the past few weeks has prevented our few words of appreciation of this magazine from appearing in FLIGHT before now. This number of the "Gloster" is certainly a remarkable one—quite the best they have yet produced—containing a variety of good things in its 159 pages. Besides illustrations from photographs of the Schneider Cup machines and R.33 as aeroplane carrier, there are numerous sketches—both serious and humorous—whilst the text includes a number of technical, semi-technical, non-technical and by no means technical articles—providing most interesting or amusing reading, as desired.

Royal Air Force Flying Accident

THE Air Ministry regrets to announce that as the result of an accident at Malta to an Avro "Bison" of No. 423 Flight, on January 18, Flight-Lieutenant Cyril Fraser Brewerton, D.S.C., Royal Air Force, the pilot of the aircraft, Edwin Chafe, Lieutenant, Royal Navy, Flying Officer, Royal Air Force, Lieutenant Guy Owen Owen-Jones, Royal Navy, and J. 39729 Leading Telegraphist George William Burton, Royal Navy, were killed.

The aeroplane had just taken off, and, still flying directly into the wind, approached the coast where the cliff is about 300 ft. high. Here the air was unusually disturbed by a gusty wind blowing seawards at about 30 miles an hour. The machine, at a height of 50 ft., was thrown out of control, the starboard lower wing struck the ground near the cliff edge, and the machine plunged into the sea. There is no indication of any defect in the aircraft or engine. Flight Commander C. F. Brewerton, who commanded the Flight, was a most skilful pilot, with many years' experience, both during and since the war.

Aldershot Command Tattoo

THE Aldershot Command Tattoo will be held on the nights of June 14, 15, 16, 17 and 18 this year, coinciding as usual with Ascot Week. Some very thrilling and interesting items are proposed, including Tchaikowsky's "1812" played by 1,000 musicians, a musical ride by 100 cavalrymen and their chargers, a modern battle and the "Battle of Blenheim," with the Duke of Marlborough leading 1,000 troops in the uniforms of that period—1704.

The Avro "Avian" Light 'Plane

THE Avro Avian 2-seater light 'plane is now in production at the Manchester works of A. V. Roe and Co., Ltd. There are two models of this machine, one fitted with the A.D.C. "Cirrus II," selling at £675, and the other fitted with the Armstrong-Siddeley "Genet," selling at £750. The machines are sold fully equipped with everything a pilot is likely to require, even for long journeys. Service arrangements have been completed, and it will be possible for owners to obtain spare parts, if and when required, from either the Hamble or Manchester works. Pilots flying the "Avian" may land at either the Hamble or Woodford aerodromes of the Avro Company free of charge, and no charge will be made for housing their machines at either place for the night.

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NEW COMPANY REGISTERED

SUPERMARINE AVIATION WORKS, LIMITED, Woolston, Southampton. Capital £300,000, in £1 shares (50,000 7½ per cent. cumulative preference, 50,000 preferred ordinary and 200,000 ordinary). Acquiring business of designers, manufacturers, etc., of flying boats, amphibian flying boats, seaplanes, aeroplanes, and other aircraft carried on by the Supermarine Aviation Works, Ltd., at Woolston, Southampton. To acquire, carry on and develop aerodromes and air stations, etc. Commander J. Bird (permanent director and chairman).

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PUBLICATIONS RECEIVED

R.A.F. Flying Training Manual. Part I. Flying Instruction. Air Publication 129. H.M. Stationery Office, Kingsway, London, W.C.2. Price 2*s.* 6*d.* net.

Catalogue

British Industries Fair, 1927: February 21–March 4. Special Overseas Advance Edition. Department of Overseas Trade (British Industries Fair), 35, Old Queen Street, London, S.W.1.

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AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motor. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

APPLIED FOR IN 1925

Published January 27, 1927

24,344. MAYOR AND COULSON, LTD., and A. DAVIES. Rotary engines. (263,540.)

24,514. H. J. ANDREWS, A. J. HUGHES, P. E. EVERITT, and H. HUGHES AND SON, LTD. Instruments for finding speed of enemy ships by aerial observation. (263,548.)

24,515. H. J. ANDREWS, A. J. HUGHES, and H. HUGHES AND SON, LTD. Torpedo-directing sight for torpedo planes. (263,549.)

28,059. H. E. S. HOLT. Apparatus for lowering mail-bags, etc., from aircraft. (263,588.)

29,898. J. MELLANDER. Propellers for helicopterous aircrafts. (263,599.)

30,056. D. J. MOONEY. Framework members for aircraft. (263,602.)

APPLIED FOR IN 1926

Published January 27, 1927

25,956. H. JUNKERS. I.c. engines with oppositely-moving free pistons. (259,914.)

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